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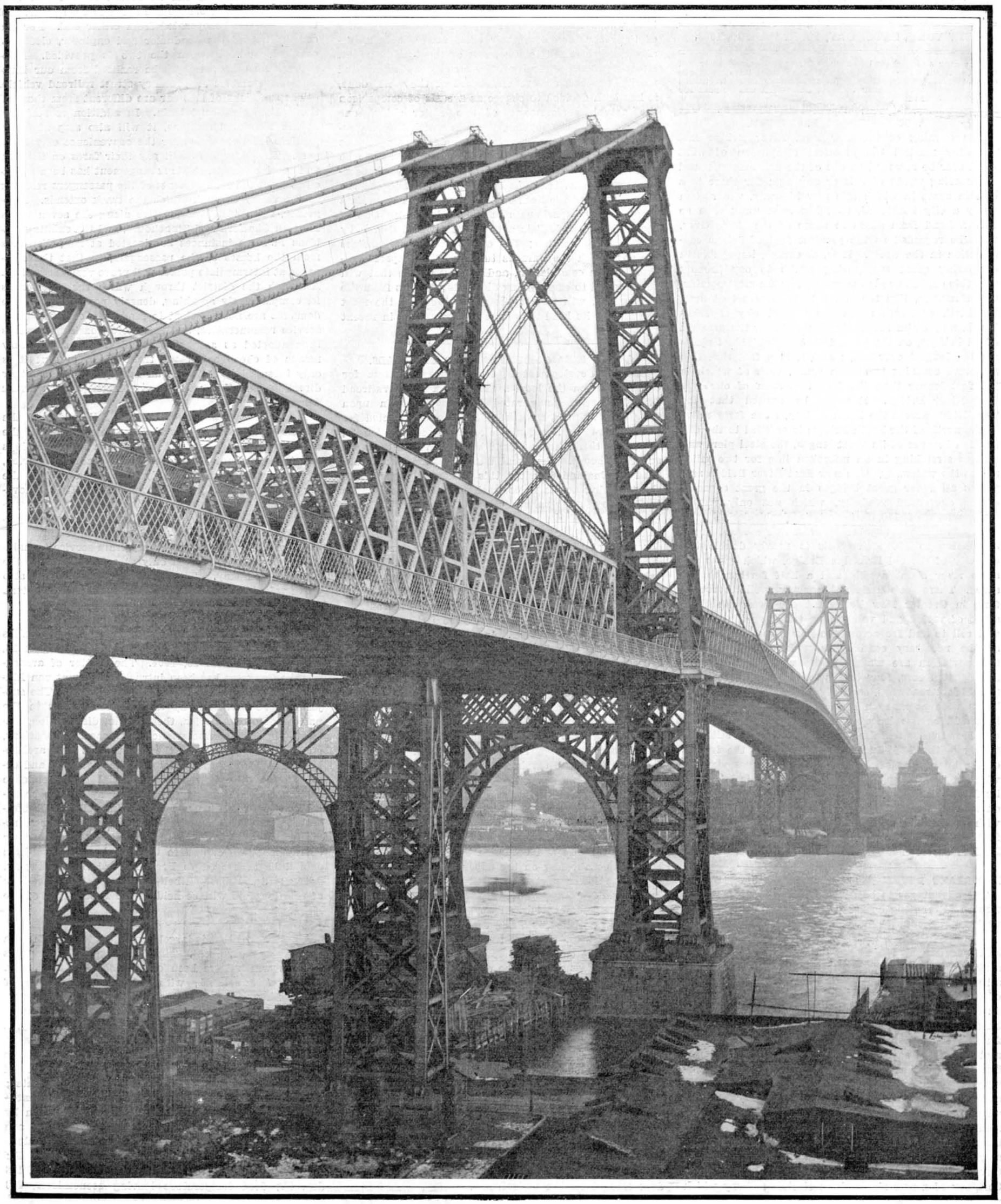

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Total Length 7,200 Feet; Length Main Span, 1,600 Feet; Width of Floor, 118 Feet.

THE NEW EAST RIVER BRIDGE, NEW YORK.—[See page 464]

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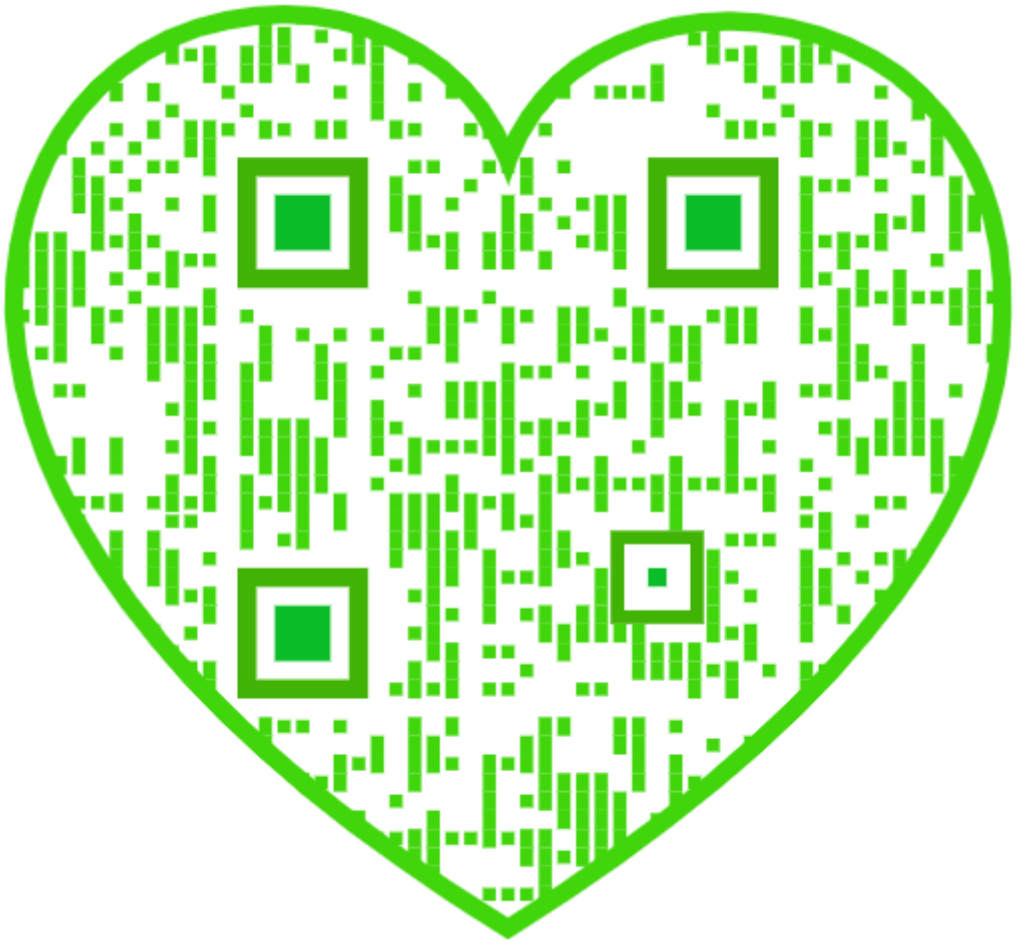

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, DECEMBER 19, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A MONUMENTAL STRUCTURE.

The opening of the new East River Bridge last Saturday marked the practical completion of what must ever be regarded as one of the most monumental engineering works of this or any age; for there is a certain sense in which this new highway, wider than many a city boulevard, that has been flung with so bold a hand from shore to shore of the East River, must be regarded as the greatest feat of bridge construction in the world. It is, of course, impossible in comparing great engineering works to say broadly that this or that one is the greatest or the most notable. One structure, like the colossal cantilevers that span the Firth of Forth above the ancient city of Edinburgh, may claim the distinction of being the greatest of all bridges, on the ground that its individual spans are the longest ever built; and it is a fact that this structure contains two main spans, each of which is 110 feet longer than the 1,600-foot span of our new East River Bridge. It might be argued that the Tay Bridge across the Firth of Tay, some forty miles to the north of the Forth Bridge, is entitled to the distinction because of its great length, the steel piers and girders stretching in an unbroken line for two miles across the waterway. The new East River Bridge surpasses all other great bridges in the great capacity of its suspended roadway, which not only has a clear width of 118 feet, but is double-decked, the total width of thoroughfare provided on the two decks amounting to 150 feet. This is nearly double the capacity of the old Brooklyn Bridge, which spans the same river about a mile and a half further to the south. There is no boulevard, nor any public thoroughfare, in Greater New York that can present such a scene of varied and voluminous traffic as that which will roll to and fro across the new structure, as soon as the necessary connections with our systems of transportation are made. There will be two tracks for elevated cars, four tracks for street railway cars, two 18-foot roadways, each of which, by the way, will be as wide as many a country turnpike, while overhead will be two fenced-off roadways for bicycles and two broad footwalks for foot passengers. So stiff and strong is the 1,600-foot span, so great is the inertia of the huge mass of steel framing and truss work of which it is built up, that when the bridge is loaded to its fullest daily capacity, it will hold the broad sweep on which its cables and floor system have been swung with so little variation of form, with such slight deflections, that it would take an engineer's transit and level to detect them.

IMPORTANT DEVELOPMENT IN ELECTRIC TRACTION.

The advantages to be derived from the use of high-tension alternating current directly at the motors are well understood, and the memorable controversy which took place in London recently between the Ganz alternating-current system and the American direct-current system is fresh in the public mind. If high-pressure alternating current can be used directly at the motors of the car, it becomes possible to make a great reduction in the cost of the line wire, and at the same time the cost of the expensive sub-stations and plant for the conversion of the alternating current to direct current is saved. The alternating polyphase motor, however, has drawbacks which in many quarters are considered to more than offset the advantages above referred to, and it was these considerations which led, in the case of the controversy of the equipment of one of the London underground railways, to the adoption of the low-pressure, direct-current system, as almost universally used in this country. Two or three months ago, however, reports reached us from Germany of a new single-phase electric railway which was stated to be showing very satisfactory results. The single-phase traction motor, unless it develops some unforeseen difficulties, should enable us to secure all the advantages of transmission of the alternating system with the advantages of convenience and flexibility of operation of the direct-current motor. We shall watch the performance of this new road with the greatest interest; for if they have produced in Germany a really reliable single-phase traction motor, they have taken a long step toward the practical application, the commercial application, of the high speeds which have recently been developed on the Berlin-Zossen line.

THE CUNARD COMMISSION TURBINE TEST.

The Cunard Turbine Commission has lost no time in prosecuting its work of gathering reliable data concerning the performance of the turbine as compared with the reciprocating type of steam engine. Although the commission is examining each type of turbine whose design or performance renders it worthy of their consideration, their chief attention is naturally being directed to the work of the turbine afloat. Because of the difficulty of securing, in the case of marine engines, an exact measure of the work done, it has been decided to choose as a basis of comparison the actual performance of two sister ships, one equipped with the turbine, the other with the reciprocating engine. Accordingly, two steamboats of the London, Brighton and South Coast Railway are to be chartered and subjected to a highly scientific comparative test in service. The two boats were built at the same yard, and the lines of both were drawn upon data furnished by experiments in the model tank. One of them, the "Arundel," is a twin-screw vessel driven by reciprocating engines; the other, the "Brighton," is equipped with the Parsons turbine. The expert character of the commission, and the great care that will be exercised to exclude any disturbing factors from the comparison, will render their report one of the most valuable of its kind that have been rendered in recent years.

A NEW STEAM MOTOR CAR FOR RAILROADS.

Another development of the motor-car system for operation upon the local sections of a trunk railroad line, has been inaugurated in Great Britain upon the Great Western Railroad. The section selected for this new service is a distance of seven miles in length, extending through the Stroud Valley between Chalford and Stonehouse. The Great Western is the second railroad in England to adopt this system of catering to the traveling public in connection with short-distance traffic, the pioneer railroad being the London & South-Western, which introduced a similar service upon the Flatton local line of its system, and which we fully described at the time in the SCIENTIFIC AMERICAN.

Steam has also been adopted upon the Great Western vehicle as the propelling power, but the design of the vehicle is very dissimilar to that of the rival company, while furthermore its functions are different.

The cars have been constructed from the designs of Mr. C. J. Churchward, the locomotive superintendent of the Great Western Railroad, and each vehicle is self-contained. The coach measures 57 feet ¾ inch from end to end, by 8 feet 6¾ inches wide, and 8 feet 2 inches in height (inside measurement). It is carried on steel underframes, supported upon two four-wheeled bogie trucks, one at either end. The forward bogie truck carries the engine and boiler. The wheel base of the coach is 45½ feet, and the motor bogie is 8 feet long, and the carriage bogie has a length of 8½ feet.

The car is divided into the passenger compartment and a small cab forward for the engineer or driver. The former is 39 feet in length and has accommodation for 52 passengers. The structural framing of the vehicle is of Baltic and Canadian oak, with paneling of Honduras mahogany on the upper part of the outside, while the lower part is incased with narrow match boarding.

The compartment is well appointed. The finishing work is in polished oak, and the roof is painted white with blue lines. The passenger seats are arranged longitudinally on either side of the vehicle near the ends, with cross seats in the center, the former having space for 36 passengers and the latter for 16 passengers. The seats are composed of woven wire with plaited rattan cane. The longitudinal seats are arranged in groups of three, each capable of seating three passengers. Depending from the roof on either side are brass rails attached to pendants, carrying leather hand loops to assist the passengers in walking through the coach while in motion. The car is entered at the rear end through a vestibule, 4 feet long, fitted with steps to facilitate passage to the car. Sliding doors of polished oak with glass panels allow communication between the vestibule and the passenger compartment. The cars are illuminated with 14 candle power gas lamps, the gas for which is stored in cylinders carried on the underframe.

The motor is placed underneath the vehicle upon the leading bogie truck. Steam is supplied from a vertical boiler with cone top, 9 feet 6 inches in height by 4 feet 6 inches in diameter, fitted with 477 fire tubes of 1⅛ inches diameter. The working pressure is 180 pounds per square inch. The motor has 12 x 16-inch cylinders. It is attached horizontally to the bogie frame, and it drives the trailing pair of wheels, which are coupled to the leading pair of wheels. The diameter of the wheels is 3 feet 8 inches. The cylinders have balanced slide valves on top, and the valve motion is of the Walschaert type. With the boiler working at 180 pounds pressure to the square inch, the tractive force is 8,483 pounds. The water for the boiler is contained in a tank having a capacity of 450 gallons, carried under the car. Steam is generated by coal fuel. Although the engineer's compartment, which is 12 feet 9 inches in length, is placed at the forefront of the vehicle, the car can be driven from either end. Hand and vacuum brakes are fitted to each bogie, and these also can be operated from either end. For the convenience of the conductor and engineer, electrical communication between the two is provided. Altogether, the coach, as may be realized from our illustration, resembles an ordinary street railroad vehicle.

The functions of this car are different from those of the ordinary railroad train. In addition to stopping at the scheduled stations, it will also stop at intermediate level crossings for the convenience of passengers. The passengers will pay their fares on the car, and receive tickets. This arrangement has been adopted to meet the requirements of the passengers residing in the valley through which the track extends. Altogether, some 40,000 people live along the seven miles between Chalford and Stonehouse, and the existing stations in some instances are located at long distances from the homes of the passengers, so that the stoppages at intermediate points will prove very convenient. Although the district through which the track runs is, comparatively speaking, densely populated, yet the demands are not sufficient to render an ordinary train service remunerative, and this motor-coach system has been adopted as a more economical and satisfactory means of cheap and rapid transit. At present it is only intended to maintain an hourly service in either direction, but this will be accelerated as the traffic demands increase.

The trial trip was made with a full load, and the vehicle was always under the complete control of the engineer. Even when stopping at the level crossings on steep gradients, the coach was readily restarted, and the brakes proved highly efficient in holding the car stationary under such conditions. This innovation is purely an experiment, but should it prove successful in coping with the traffic demands upon this short section, it will be developed upon other local lines of the system, where an ordinary train service is maintained in many instances only at a heavy loss to the railroad company. These motor coaches will also prove valuable feeders to the trunk roads of the system.

THE NEXT CONGRESS OF AMERICANISTS.

The Fourteenth Annual Congress of Americanists will be held at Stuttgart from Thursday, August 18, to Tuesday, August 23, 1904. The matter of arranging the Congress has been intrusted to Count von Linden, Prof. von den Steinen, and Prof. Seler. The subjects to be discussed by the Congress relate to the native races of America, their origin, distribution, history, physical characteristics, languages, inventions, customs, and religions; the monuments and archæology of America; the history of the discovery and occupation of the new world. Special correspondence relating to anthropology and ethnography is to be addressed to Prof. Karl von den Steinen, Berlin-Charlottenburg, Hardenbergstrasse 24. Correspondence relating to archæology, to the history of the discovery of the new world, and to Central American subjects should be addressed to Prof. Eduard Seler, Steglitz, near Berlin, Kaiser-Wilhelmstrasse 3. The meetings of the Congress will be held at the Festiv Hall of the Koenigsbau.

A native fuel that is largely used for steam raising in India is Seebpore coal. The following are the results of tests which have been carried out by Mr. Fredk. Grover, A.M.Inst.C.E., with this fuel: Duration of test, six hours nine minutes; number of boilers in use, six; type and dimensions of boilers, two-flued Lancashire, 8 feet by 30 feet; draft at base of chimney, 1 inch of water; draft in the main of flues, ¾ inch; total number of pounds of water evaporated, 180,000; total number of pounds of coal used, 22,570.5; actual evaporation per pound of coal, 7.97 pounds water; evaporation from and at 212 deg. F.—equivalent—9.15 pounds water; maximum possible evaporation by calorimeter, 12.5 pounds water; percentage of ash drawn from boilers, 16.7; percentage of ash from calorimeter, 11.5; original feed temperature, 100 deg. F.; feed temperature after heating by exhaust steam, 138 deg. F.; feed temperature leaving economizers, 240 deg. F.; coal fired per square foot of grate area, 19.1; total efficiency of the plant, 73 per cent; pressure of steam in boilers, 125 pounds per square inch; percentage of CO_2 in main flues, 8.4 per cent.

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THE DEATH OF HERBERT SPENCER.

On December 8 Herbert Spencer, heralded as the "last of the great thinkers of the Victorian age," passed away at the age of eighty-three.

Herbert Spencer was born at Derby on April 27, 1820, the son of William George Spencer, a distinguished teacher of mathematics. He was educated by his father and by his uncle, the Rev. Thomas Spencer, a liberal-minded clergyman. At the age of seventeen he worked for the London and Birmingham Railroad as a civil engineer, following the profession with some little success. He assisted his father in philosophical experiments; and on his own account he began an enthusiastic study of the insect world, which resulted in a splendid collection of winged insects. The study of botany engaged no little of his time. He invented a new style of botanical press, and devised other improvements in botanical apparatus. His inventive faculties also found expression in the construction of printing presses and the making of type by compression of the metal instead of by casting. He was the inventor of the glyptograph style of engraving.

It was in 1852 that Spencer began to write his elaborate essays on the evolution theory, with which his name will ever be associated. At first his written work met with scant success. The publisher of his "Social Statics, or the Condition Essential to Human Happiness," had the first edition on his shelves for fourteen years before he sold it. The edition of "Principles of Psychology," one of the best known of his books, was disposed of only after the lapse of twelve years.

Although the public was slow to recognize Spencer, it must be confessed that English philosophers held out a helping hand to him. John Stewart Mill offered to assist him in circulating his writings by raising a guaranty fund to indemnify the publishers. Spencer declined the offer, preferring to allow his books to win recognition on their own merits.

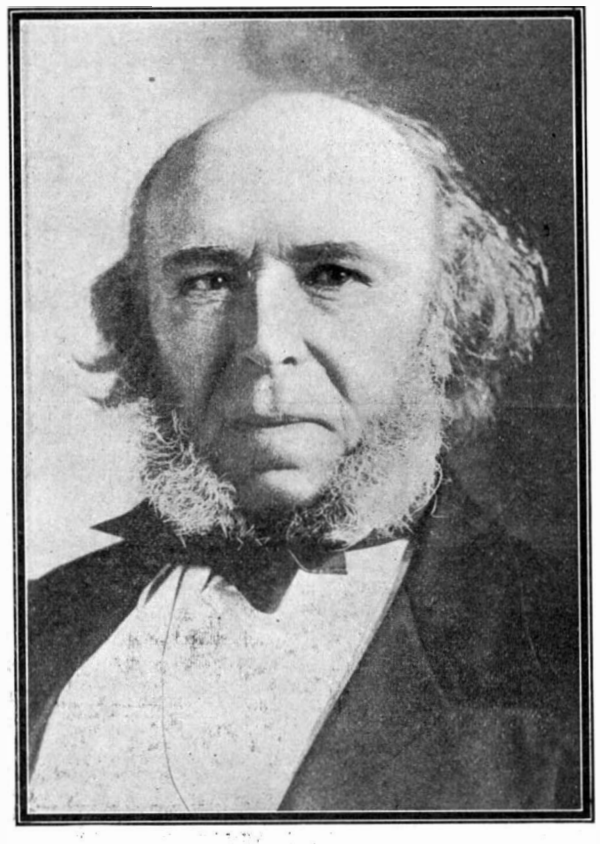
It was in 1860 that he first announced his celebrated philosophical system of evolution. Coming, as it did, soon after the appearance of Darwin's "Origin of Species," when the public's interest was more or less aroused in the subject, his views met with somewhat heartier accord than had been their lot before.

To the credit of Americans be it said that they were among the first to appreciate properly the philosophical merit of Spencer's work. Indeed, American students have been among his most ardent supporters. They enthusiastically adopted his views, bought his books, and fought for his ideas. How great was the appreciation of Americans for Spencer's contribution to the theory of evolution was shown at the time of the philosopher's visit to America in 1882, an event rendered memorable for a remarkable address on relaxation. It was in this address that he divided social life into three stages—war, work, and relaxation—and declared that men were overworking themselves absurdly. "We hear too much of the gospel of work," he said. "It is time to preach the gospel of relaxation." He himself carried out his own theories of relaxation, working in late years only three hours a day—work which was spent on his "Synthetic Philosophy," published in 1896. The Athenæum Club was the scene of his recreations. There he went to drink tea, to smoke mild cigars, and to play billiards, a game in which he had acquired no little mathematical skill in planning his shots. It was in the Athenæum billiard room where an epigram was uttered which has since become famous. Spencer had been playing billiards with a member who knew little of mathematics, but who did know how to play billiards. The unmathematical member beat the mathematical Spencer at the first game of billiards. Spencer tried again. The second game was another defeat for the philosopher. Spencer walked over to the rack, put his cue up, and remarked to his opponent: "Sir, to play a good game of billiards is a mark of a well-rounded education; to play too good a game of billiards is a mark of an ill-spent youth."

It hardly falls within the province of this journal to give an estimate of Herbert Spencer's philosophical work—work which was done largely in the field of speculative rather than in applied science. What the world owes to him chiefly is the destruction of old prejudices and traditions, the forcing of educators to make allowances for youthful immaturity in the bringing up of children. He did what he could to introduce a more rational consideration of things, particularly in the sphere of religion. Perhaps the book by which he is best known is his "First Principles," issued at his own expense in 1862—a book which brought him into notice, it is true, but which made him the object of a storm of abuse from philosophical conservatives. His argument that force never disappears, but is only transferred, is now a commonplace scientific axiom, but in his day it was the height of impiety. His "Principles of Psychology" shows how much he owed to Darwin, particularly in the physiological point of view which he took. It was only after he had issued the prospectus of his "System of Synthetic Philosophy" that he was recognized as a teacher of the doctrine of evolution.

Herbert Spencer was an Englishman to the manner born—cold, self-contained, rather narrow in his point of view toward foreigners. He never deigned to learn a foreign language. Perhaps his rather contemptuous dismissal of Kant's philosophy may be partly explained by this singularly British attitude. He refused membership of all scientific academies. For him it was most remarkable that he ever undertook to travel to America. The reason is probably to be found, as we have said before, in the enthusiastic reception accorded by America to his work. He was not much of a reader, although his works are erudite to a degree. Most of the facts presented were collected by assistants. His intensely British character caused him to become a most vigorous opponent of socialism. He looked upon mankind as the highest form of specialization in nature, and would hear nothing of restricting the liberty of the individual more than was absolutely necessary for the cohesion of society. Of the works composing his philosophical system, the following deserve particular mention:

"First Principles," 1862 (seventh edition, 1889); "The Principles of Biology," two volumes, 1864 (fourth edition, 1888); "The Principles of Psychology," two volumes, 1872 (fifth edition, 1890); "The Principles of Sociology," one volume, 1876 (third edition, 1885); "Ceremonial Institutions," 1879 (third edition, 1888); "Political Institutions," 1882 (second edition, 1883); "Ecclesiastical Institutions," 1885 (second edition, 1886); "The Data of Ethics," 1879 (fifth edition, 1888); "Principles of Ethics," 1892. Mr. Spencer's other works published since 1860 were as follows:



HERBERT SPENCER.

"Education—Intellectual, Moral, and Physical," 1861 (twenty-third edition, 1890); "Essays—Scientific, Political, and Speculative," two volumes, 1858-1863 (fourth edition, three volumes, 1885); "The Classification of the Sciences, to Which Are Added Reasons for Dissenting from the Philosophy of M. Comte," 1864 (third edition, 1871); "The Study of Sociology," 1873 (eleventh edition, 1885), and "The Man versus the State," 1884 (eighth thousand, 1886).

DEATH OF REAR ADMIRAL BANCROFT GHERARDI.

Rear Admiral Bancroft Gherardi, retired, died at Stratford, Conn., on the 10th instant, where he had lived for several years. He retired from active service in 1894. He was born November 10, 1832. His father was of Italian descent, and his mother was a sister of George Bancroft, the historian. He was a graduate of the Annapolis Academy. In 1858 he was navigating officer of the "Niagara" at the laying of the first Atlantic cable.

During the civil war, in July, 1862, he became lieutenant-commander while attached to the South Atlantic blockading squadron, and was first engaged in active war at Fort Macon.

In the battle of Mobile Bay, Gherardi's vessel, the "Port Royal," which was, with the "Richmond," lashed to Captain Jenkin's vessel, was ordered cast off and gave chase to the rebel gunboats "Morgan," "Gaines," and "Selma," drawing their fire from the United States fleet, and materially assisting in Farragut's victory. In this action he distinguished himself for his coolness and bravery.

In 1866, becoming commander, he was stationed at the Philadelphia navy yard and remained there till 1870. In August, 1887, he was commissioned to the rank of rear admiral and was ordered to the command of the New York navy yard. In 1889 he became commander in chief of the North Atlantic Squadron. In 1893 he, with the flagship "Philadelphia," had command of the naval parade in the North River, which was very successfully carried out.

Admiral Gherardi was at the Barbados when the trouble with Chile occurred, and distinguished himself by the celerity with which he assembled our naval forces in readiness for threatened war. His last public appearance in Stratford was when he represented on the platform the United States navy at the union church McKinley memorial services, September 19, 1901. He was conspicuous in promoting the development of the present modern navy.

SCIENCE NOTES.

The cinematograph seems to have been rather successfully used by Paris surgeons for a very novel purpose, namely, that of exhibiting to medical students how typical surgical operations should be carried out.

Alcohol, suitable as a substitute for ordinary alcohol, is obtainable, according to a German inventor, from fæces by submitting the fæces to dry distillation, absorbing the gases produced in water, and distilling the mixture thus obtained. The residues from this last distillation may be used as the medium for absorbing the gases.

In a recent dissertation President Eliot, of Harvard, states that "the whole store of knowledge now available is too vast for any man to master, though he had a hundred lives instead of one, and its growth in the nineteenth century was greater than in all the thirty preceding centuries put together. . . . Culture, therefore, can no longer imply a knowledge of everything—not even a little knowledge of everything. It must be content with general knowledge of some things, and a real mastery of some small portion of the human store."

Roman relics have recently been dug up in the heart of Paris. The distinguished French archæologist, Charles Magnew, has made excavations in the Rue Cassini, where he had long suspected there lay remains of old Roman glories. He discovered the cover of a tomb on which is sculptured in bas relief a Roman blacksmith, wearing his apron. In his left hand he brandishes a long pair of pincers and a forceps. The right arm is broken off, but probably held a hammer. Mr. Magnew judges from the style of the work and from a piece of money of the time of Nero found near the tomb, that the work is of the first century.

THE CURRENT SUPPLEMENT.

On December 19, the great bridge which for the past seven years has been in course of construction across the East River was opened with appropriate ceremonies by the Mayor of New York. The bridge spanning the river from the foot of Delancey Street, Manhattan, to the foot of South Fifth and South Sixth Streets, Brooklyn, has a total length of 7,200 feet. From anchorage to anchorage this huge structure has a clear width of 118 feet, providing two elevated railway tracks, and two 18-foot roadways, two footpaths, and two bicycle paths. There is no bridge in the world that can compare with this in carrying capacity. In the current SUPPLEMENT, No. 1459, will be found what may well be considered one of the most exhaustive accounts of the construction of this bridge from the engineering standpoint, an account which is the result of a constant study of the bridge from the time excavation was first begun to the time when Mayor Low dedicated it to the public. Among the other articles of the issue may be mentioned a most interesting one by Prof. Fischer on "Mechanics as Exemplified in the Human Frame." The Lebaudy airship disaster is described and illustrated. The usual trade notes and miscellaneous notes will be found in their customary places.

The death is reported of James N. Skinner, the inventor of the well-known Skinner chuck and a number of other mechanical contrivances. At different times he was connected with the Springfield Armory and Howe Sewing Machine Company; but afterward went with the E. Horton Company, at Windsor Locks, builders of chucks. He was with this concern fourteen years, during which time Mr. Skinner took out a number of patents, relating principally to chucks. He engaged in the manufacture of chucks of his own design in 1880, and seven years later the Skinner Chuck Company was organized, and since that time he had been with the company in the capacity of superintendent and director. Mr. Skinner's death took place on November 8 at New Britain, Conn.

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THE LAUNCH OF THE NEW TRANSATLANTIC LINER "BALTIC."

BY HAROLD J. SHEPSTONE.

The White Star Line have added another great vessel to the fleet of the International Mercantile Marine Company in the "Baltic." She is 1,930 tons larger than her sister ship, the "Cedric," making her far and away the biggest vessel ever built. Over all the "Baltic" has a length of 725 feet 9 inches, a breadth of 75 feet, and a depth of 49 feet. Her gross tonnage will be nearly 24,000 tons, her capacity for cargo about 28,000 tons, and the displacement at her load draught 39,800 tons, more than double that of any battleship afloat. It is interesting to compare these measurements with those of other large ships. They work out as below.

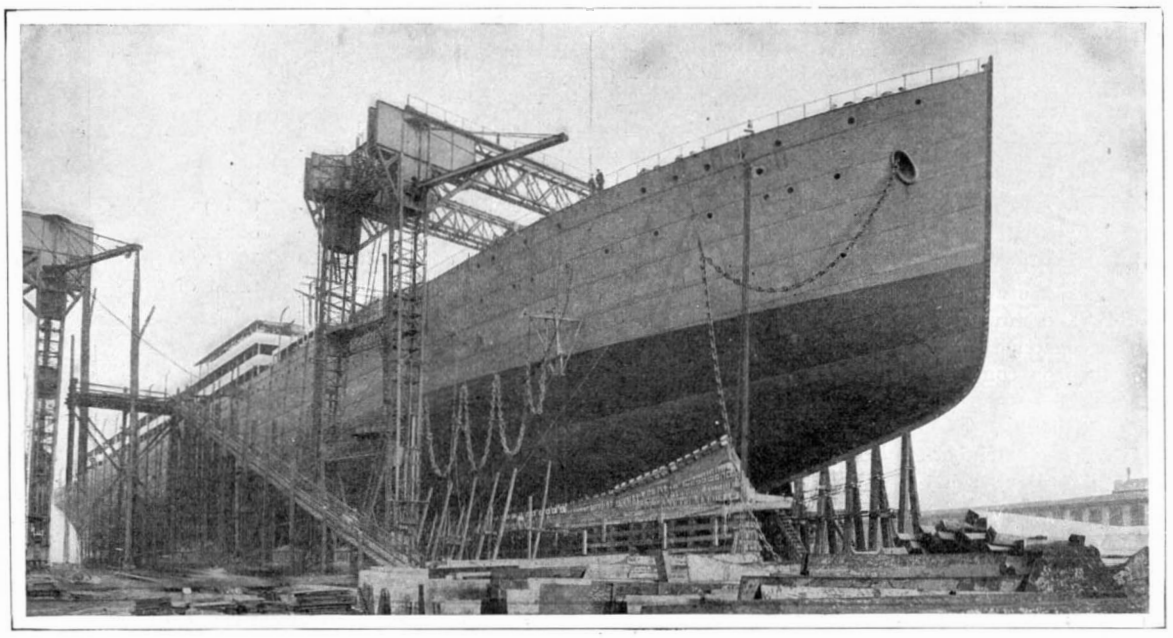
	Length. Ft.	In.	Breadth. Feet.	Depth. Feet.	Gross Tonnage.	Displacement. Tons.	Speed. Knots.
"Baltic"	725	9	75	49	24,000	39,800	16½ to 17
"Cedric".....	700	0	75	49	20,970	37,870	16
"Kaiser Wilhelm II"	706	6	72	44	20,000	26,000	*23
"Deutschland"	684	0	67	44	16,000	23,620	23.5

* Contract speed.

The launching, considering the nature of the event, was a comparatively quiet affair. The attendance was fairly large, but not nearly so large as it should have been when we consider that the largest ship in the world was about to be released from her position on the stocks and entered upon her work as a world's carrier. She glided slowly but gracefully into the river, and was brought up to her berth alongside the wharf with very little assistance from the tugs; in fact, she was considerably helped by the aid of the wind, which, at the time, was blowing a perfect gale.

It will be seen at once that the new liner is nearly 20 feet longer than the express steamer "Kaiser Wilhelm II.," and over 3,000 tons bigger tonnage than her sister ship, the "Cedric." She confirms the White Star Line's reputation of turning out the biggest thing afloat, a feat which this company have now achieved on four occasions since January, 1899, when it launched the famous "Oceanic." This ship has a length of 704 feet and a gross tonnage of 17,000 tons, or 7,000 tons less than the "Baltic." A growth of seven thousand tons in less than five years must be regarded as a remarkable achievement, and an example of the wonderful progress in modern shipbuilding. Twenty years ago there was only one steamer, except the "Great Eastern," which measured more than 8,000 tons gross. One has to remember, perhaps, that the great Cunarders will probably measure over 24,000 tons, but there is still time for the owners of the White Star Line to build another vessel larger than the "Baltic" before the Cunard steamers are launched.

The "Baltic" belongs to the same class of ships to which the "Cedric," "Celtic," and "Oceanic" belong. She will be famous for her large carrying capacity, and her steadiness in rough weather rather than for her speed.



Length, 725 ft. 9 in.; beam, 75 ft.; depth, 49 ft.; displacement, 39,800 tons; speed, 16½ knots.

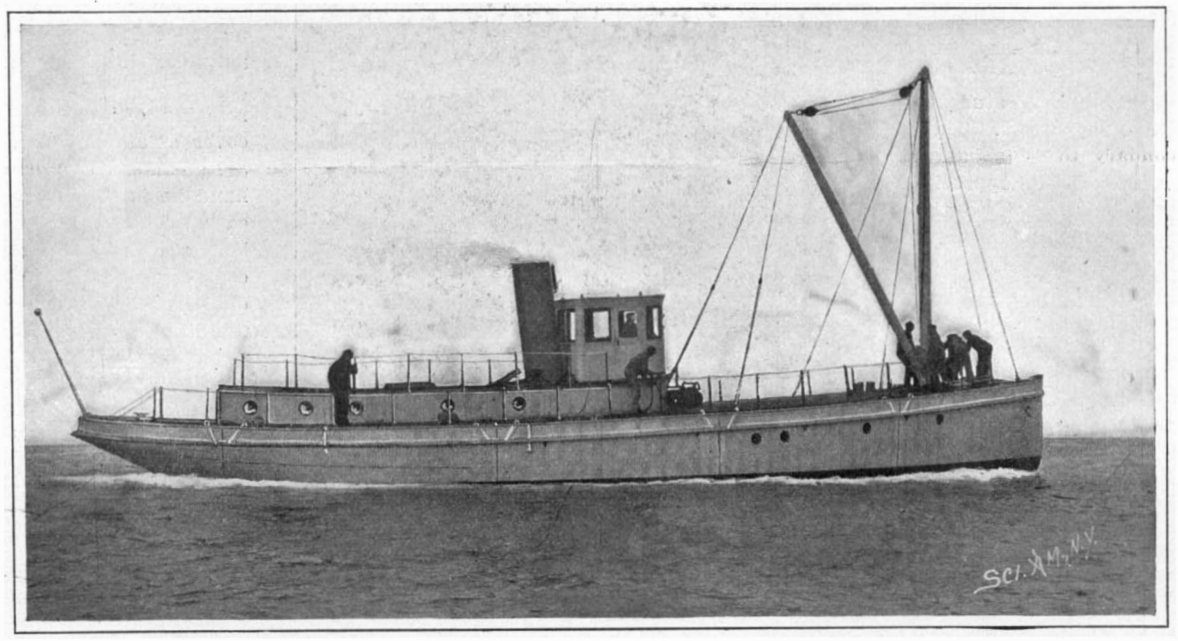
THE "BALTIC," THE LARGEST SHIP AFLOAT.

The new vessel will be well appointed, the interior arrangements and decoration being similar to those carried out on the "Cedric." Being larger, the accommodation will be even more commodious; the first-class dining-saloon, for instance, will be several feet longer. It will be situated on the upper deck, extend the full width of the ship, 75 feet, and will be exceptionally lofty and airy. It will seat 370 persons. Altogether, there will be accommodation for nearly 3,000 passengers, besides a crew of about 350.

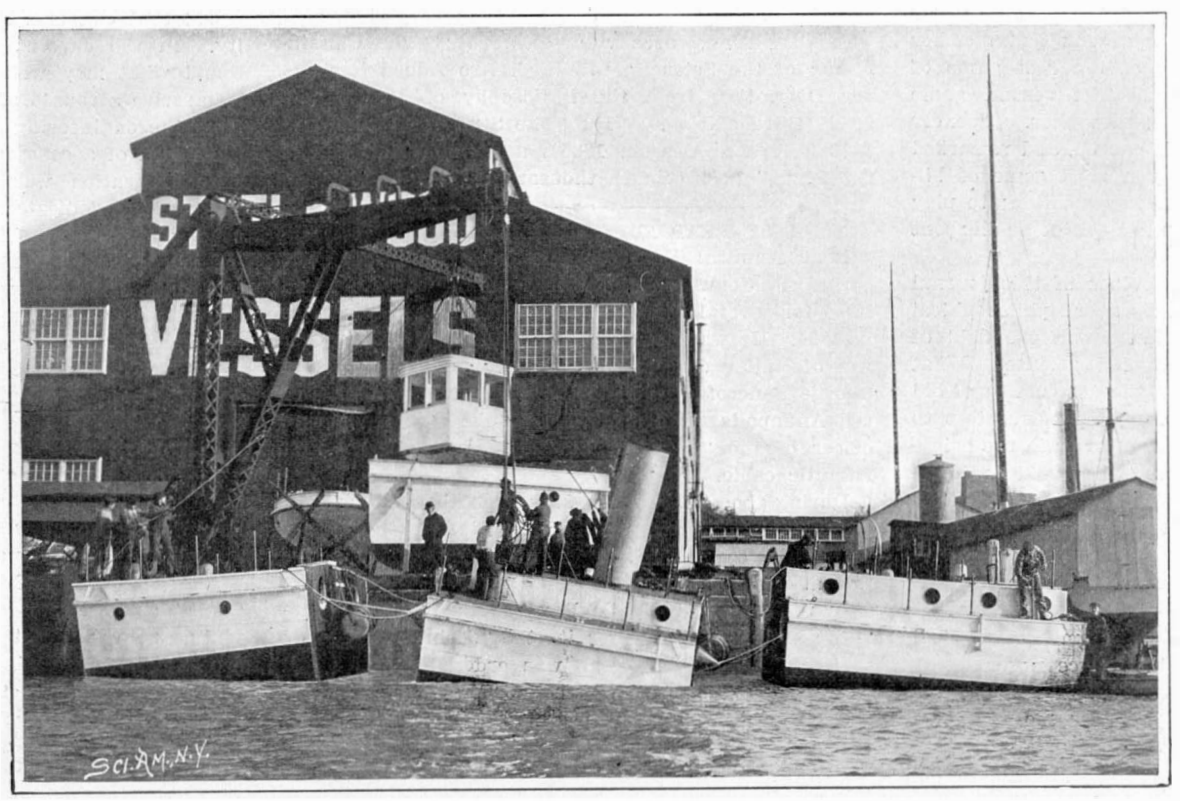
The "Baltic" is constructed on the cellular, double-bottom principle, and is divided into many water-tight compartments, exceeding all official requirements in this respect. The engines will be of the Harland & Wolff quadruple-expansion balanced type, having cylinders 33 inches, 47½ inches, 68½ inches, and 98 inches in diameter, with 5 feet 3 inches stroke. Steam is supplied at a pressure of about 210 pounds by eight double-ended boilers, each about 16 feet by 19 feet 6 inches, which will drive the monster at a speed of from 16½ to 17 knots per hour.

Compared to the German fliers, the "Baltic" is a decidedly slow boat. She is nevertheless a money earner. Her working expenses must be less than half those of say the "Kaiser Wilhelm II.," while she will carry nearly double as many passengers besides 28,000 tons of cargo. It is well known that the "Baltic" was insured by her owners against construction, launch, and trial risks for slightly over $1,500,000. If this figure can be taken as any guide to the cost of such a vessel, she is cheap, remembering that the bills for the "Kaiser Wilhelm II." totaled $6,500,000.

It is interesting to note that the tonnage of the White Star fleet now amounts to the huge total of 350,000 tons. It consists of 29 steamers, of which 25 are fitted with twin screws, and possesses no fewer than 21 vessels of over 10,000 tons each, including three of over 20,000, one of 17,000, and two over 15,000 tons. One can well remember the controversy in shipping circles on the wisdom or folly of building vessels 700 feet long when the first 700-footer was launched, only a few years ago. It would seem that the 800-foot boat is a decided possibility in the near future. Curiously enough, however, while builders are increasing the length of their vessels, the widths and depths, particularly the latter, are being but very cautiously extended. The fact is, it is purely a question of harbor accommodation. A draught of nearly 40 feet is a serious matter, even for ports like Liverpool and New York.



THE NEW SECTIONAL STEAMER "PONTONIER" FOR THE U. S. ARMY IN THE PHILIPPINES.



THE "PONTONIER" AFLOAT IN THE DETACHED CONDITION. EACH SECTION IS CAPABLE OF FLOATING INDEPENDENTLY.

A SECTIONAL STEAMER FOR OUR COLONIAL POSSESSIONS.

The accompanying illustration shows a vessel presenting something of a novelty in marine construction, which has been induced indirectly through our recent "imperialism." Since acquiring the various outlying possessions, and particularly those lacking the development of civilization, our Army Department has become cognizant, even through its short experience, of the necessity for improved facilities in the handling of men, provisions, and munitions of war on army transports. A tender which could be taken aboard and transported bodily would have insufficient capacity; and the need for a larger boat therefore conceived the building of a sectional craft with certain new features to be introduced. Numerous boats of the sectional type have been constructed, some of considerable size, but with the intention of providing for one handling, and that they could be assembled where the facilities of shipyards and shipbuilders would be available. Our new possessions are lacking in such facilities; and again, it might be required to put the sectional boats in commission on short

(*Continued on page 463.*)

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THE NOISE OF LIGHTNING.

BY PROF. JOHN TROWBRIDGE.

Some recent experiments in the Jefferson Physical Laboratory show in a striking manner that the astounding noise of a lightning discharge is largely due to the dissociation of water vapor; moreover, the length of such discharges is greatly modified by the amount of moisture present in the clouds. This latter conclusion seems almost self-evident; but the following experiments brought out the fact with what may be truly called dazzling distinctness.

The experiments grew out of my long study of the spectrum of water vapor; and abandoning for the nonce the baffling study of the spectra of water vapor in glass and also quartz tubes, I resolved to study the spectrum produced by electrical discharges of great quantity in air saturated by moisture. In order to obtain such discharges I used a storage battery of twenty thousand cells to charge large glass condensers. I also had a transformer constructed which was excited by an alternating current of 110 volts. This transformer has several interesting features.

It consisted in the main of nineteen flat bobbins of fine wire slipped upon a laminated iron core. The bobbins are one foot across and three-quarters of an inch thick; and are separated from each other by plates of glass one-eighth of an inch thick. No insulating or otherwise protecting covering is placed upon the exposed portion of the coils. The openness of the construction permits of many methods of joining the coils for quantity or intensity; and also permits of the easy removal of any bobbin which may become defective.

The coils are slipped upon the laminated core of a closed magnetic circuit, and the electromagnets of the primary circuit of the transformer are on a portion of the magnetic circuit not embraced by the bobbins of the fine wire circuit. By this arrangement I avoided a short circuit from the secondary to the primary, and also the possible heating due to long running of the primary current. This latter point is an important one to be considered in the construction of transformers for use in spectrum analysis, where several hours of exposure are often necessary. Large wire was used in the construction of the primary coils, a method of construction due to Dr. William Rollins, of Boston. The construction of this coil is an approximation to the magnitude of transformers used in practical employments of electricity. I am firmly convinced that physicists must enlarge their experimental appliances in order to study electro-dissociation. It would be even desirable to put at the disposal of the investigator in spectrum analysis transformers of the magnitude employed by the Niagara Construction Company. The transformer I have described was excited by six amperes, and gave a spark of great body of two inches when Leyden jars were used. Fig. 1 is a photograph of the transformer one-fourteenth natural size.

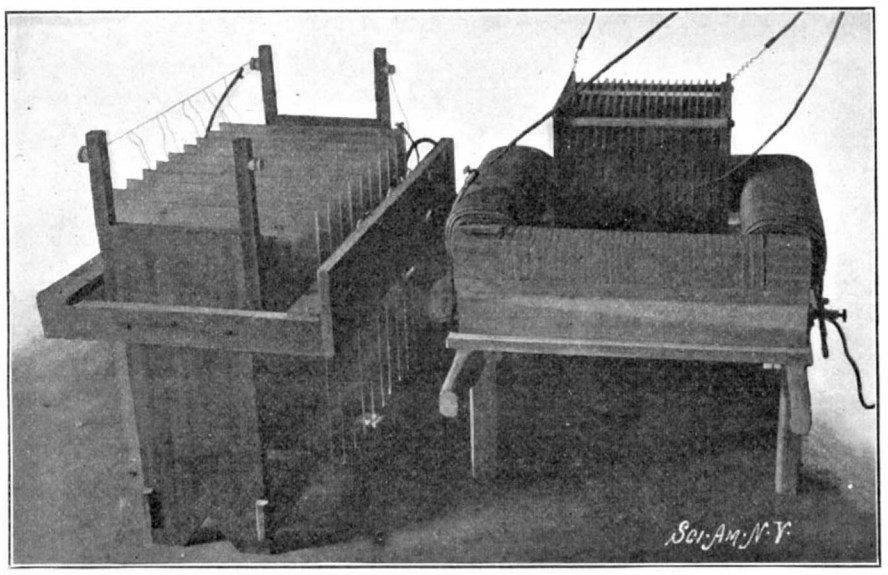


Fig. 1.—The Transformer.

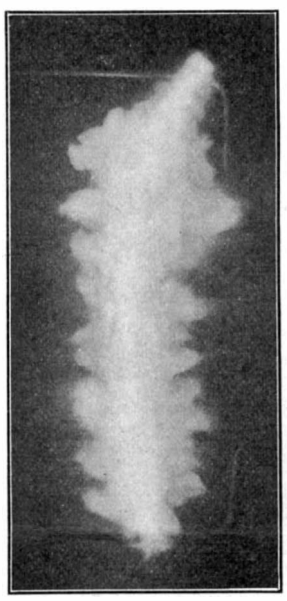


Fig. 2.—The Electric Discharge Between Water Terminals.

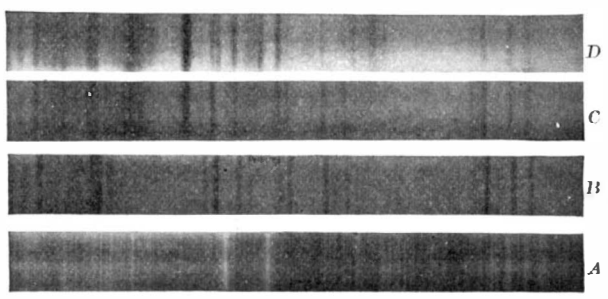


Fig. 3.—Spectrum of Water Vapor at Atmospheric Pressure, Together With Other Atmospheric Lines.

At first sight it seems possible to study the spectrum of water vapor by causing electric sparks to pass from one surface of water to another; in other words, by employing water electrodes. It is, however, practically impossible to cause an electric spark of high electromotive force to leap from one surface of a liquid to another. For this reason it is rare that lightning strikes the surface of level water.

I therefore, having saturated two pieces of wood with distilled water, wrapped them with cotton wool which was also heavily saturated with distilled water. When such terminals were separated a distance of four inches, a torrent of extremely bright sparks leaped across the interval. The noise of the discharge was deafening, and the operator was compelled to stuff his ears with cotton, and furthermore to wrap a heavy cloth around the ears. The striking distance of the sparks was increased by the employment of the wet terminals from two inches to four. The deafening noise was probably caused by the explosion of the hydrogen and oxygen gases produced by the dissociation of the water vapor. The noise of lightning discharges is doubtless enhanced in the same manner by the presence of great moisture in the clouds. Fig. 2 is a photograph of the electric discharge between water terminals, extending over the wetted surface.

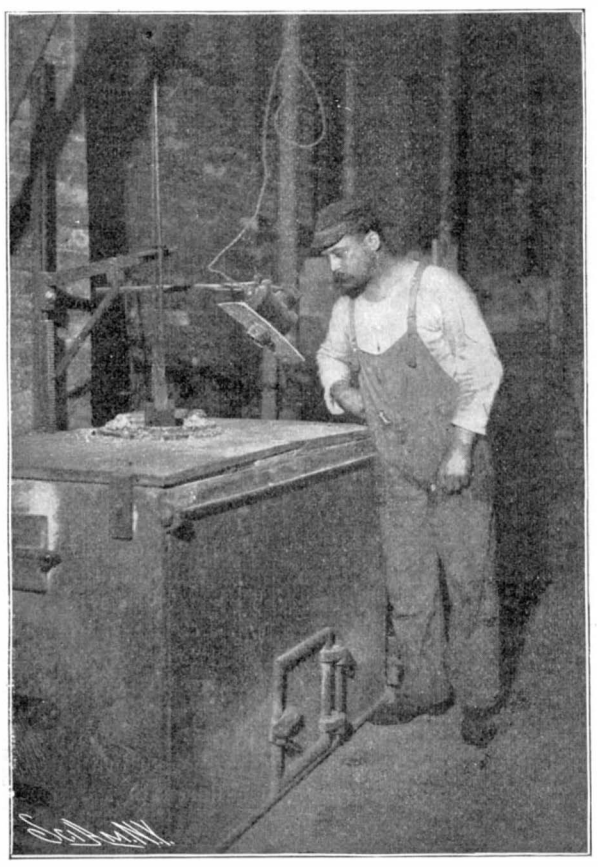
Fig. 3 shows the spectrum of water vapor at atmospheric pressure, together with other atmospheric lines. This spectrum must be regarded as the spectrum of lightning when the lightning discharge takes place in regions not more than a mile high and between clouds heavily laden with moisture. In the photograph, *A* represents the portion of the sun's spectrum near the two great *HH* lines, the strongest lines in the solar spectrum. *B* is the spectrum of water vapor with characteristic doublets; *C* and *D* are spectra of atmospheric air, showing traces of vapor.

AN OPTICAL PYROMETER.

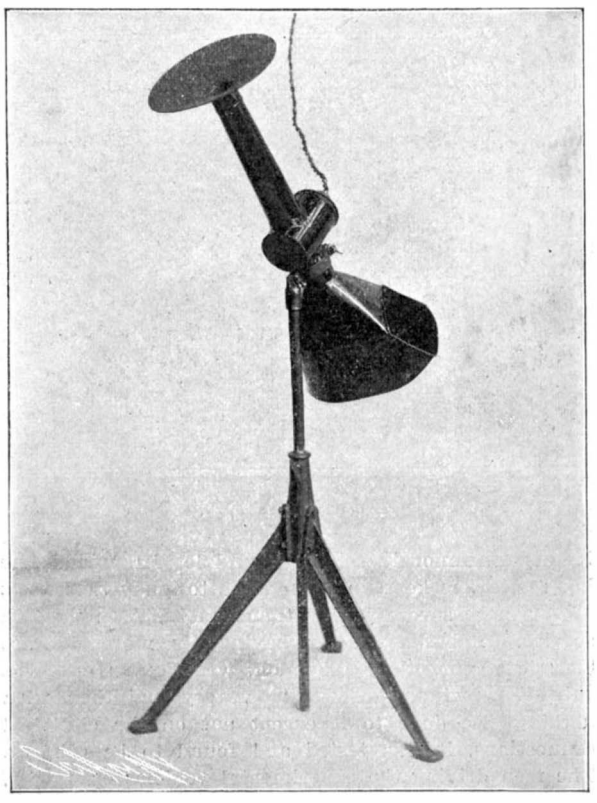
In our various industries, accurate means are provided for determining the different properties of the various materials which enter into the construction of the finished product. Lengths are measured with the greatest accuracy by aid of delicate micrometers; weights by scales of various degrees of delicacy; densities by hydrometers; and the composition of the various materials by chemical analysis, etc.; but while the lower temperatures are read by the aid of the mercurial thermometer, in these industries, the higher temperatures seem to have been guessed at, or measured by skilled observers. The operators estimate these temperatures by the color or degree of incandescence of the materials which are being heated. There are various pyrometers on the market for measuring these temperatures. Still, in the general case, the old method seems to be resorted to.

It is well known that the value of the finished product depends in a large measure upon the accuracy with which the heat treatments have been conducted. For example, the strength of structural irons and the durability of steel rails depend largely upon the temperature at which they have passed through the rolls the last time. The cost of machining tools, as well as the quality of the finished tools, depends in a large measure upon the temperature at which the steel has been annealed, and the keenness which can be given to the edge of tools, and also the length of time the tool can retain its sharpness, depends altogether upon the temperature at which it is hardened and tempered.

In many steels, the range of temperature at which

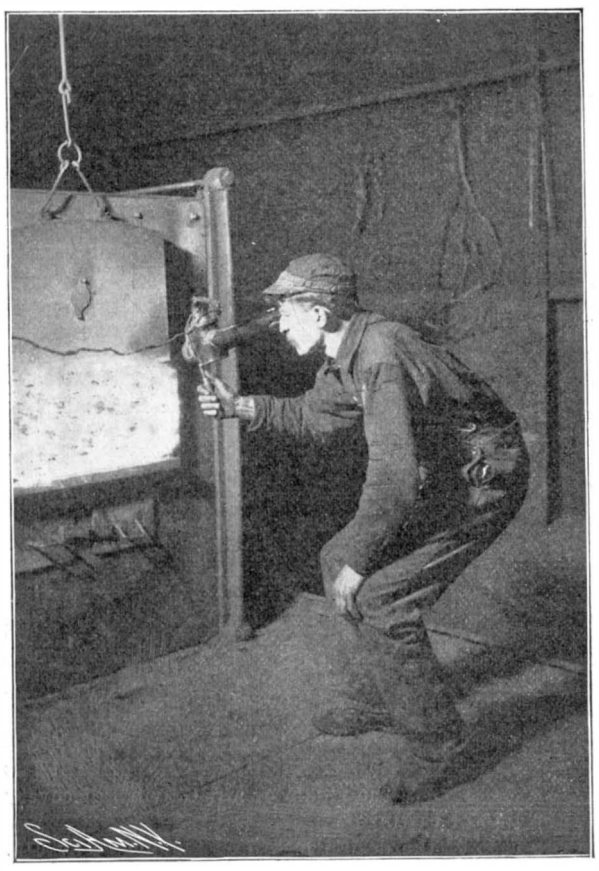


Determining the Temperature of Heated Parts.



The Thermo-Gage.

AN OPTICAL PYROMETER.



Measuring the Temperature of a Hardening Furnace.

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they can be successfully hardened is very small; but in no steel can the best results be attained in a variation to exceed 50 deg. Fahr., whereas in most steels the variation of one-fourth this amount would prove injurious.

Observations have shown that the steels which are capable of producing the best tools are those which can be hardened successfully only within narrow limits of temperature.

On account of the interest and importance of the correct measurement of temperatures, each new pyrometer that comes out is of interest to the public just in proportion to its possibilities in filling the requirements. The Morse Thermo-Gage Company, of Trumansburg, N. Y., have brought out a thermo-gage which will be of considerable interest. This thermo-gage is based on the comparison of color or degree of incandescence.

While these patents cover a multitude of forms in which the gage can be used, the form which is generally used is illustrated. In further explanation of the construction of the gage, we would add that inside the lamp tube illustrated is provided an incandescent lamp with a large filament in the form of a conical coil.

This filament is heated to the different degrees of incandescence corresponding to the different temperatures by an electric current taken from a storage battery. In the circuit of the lamp is included a delicate ammeter and a rheostat with finely-divided increments of resistance. With the aid of the rheostat the amount of current passing through the lamp can be regulated to any degree, and can be read on the scale of the ammeter. A table accompanies the instrument, which will enable the operator to know the temperature of the filament by the readings from the ammeter.

When this filament is superposed over the substance whose temperature is to be gaged, so that the substance can be viewed through the spirals, it will appear as a more or less bright spiral against said substance if it is at a higher temperature than the substance; on the other hand, if it is at a lower temperature, it will then appear as a more or less dark spiral against it; but when the substance and filament are at the same temperature, then the filament will apparently be obliterated from view, and appear to merge into that of the substance. This is because the rays then emitted by the substance whose temperature is to be gaged are identical with the rays emitted by the filament, and therefore the eye detects no difference. This merging effect is a well-defined phenomenon, and will enable the operator easily to read temperatures accurate within 5 deg. Fahr.

If it is desired to measure the temperature of any substance heated to incandescence, the substance is viewed through the lantern tube and the coils of the filament, and the incandescence of the filament is changed by the rheostat until it merges into the substance, when it will be at the same temperature as the substance, and the temperature can be read by the aid of the ammeter and the table accompanying the instrument. If, on the other hand, it is desired to heat a substance to a certain temperature, then the current is regulated by the rheostat until the ammeter indicates the desired temperature; then, as the substance is heated, it is observed through the tube, and the instant that its temperature is such that the filament of the lamp merges into it, it will be at the desired temperature.

AN ODD CASTING.

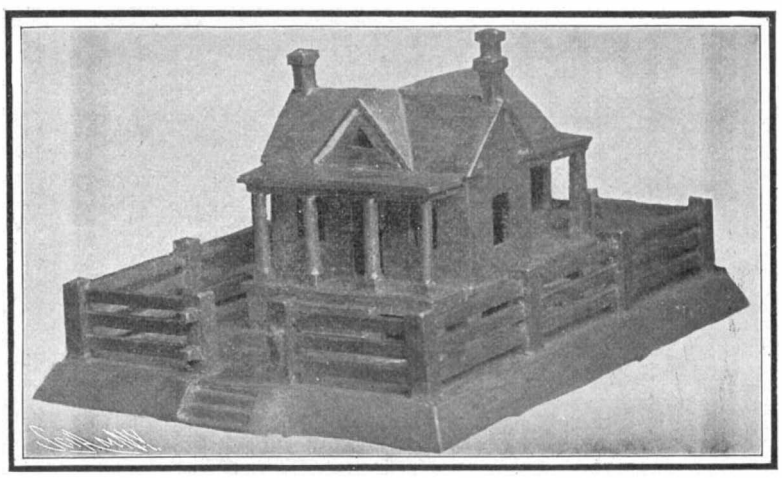
The accompanying photograph is a picture of a unique casting recently turned out by Daniel Galvin, a skilled artisan and molder of this city. Mr. Galvin calls the design "The Old Kentucky Home," and its chief claim to distinction lies in the fact that it was made at one casting.

A few years ago Mr. Galvin created something of a sensation among molders all over the country by turning out complete, at one cast, a metal representation of the "Old Oaken Bucket." His latest achievement, on which he worked for some months, at leisure moments, far surpasses his first effort in this line.

"The Old Kentucky Home" is of brass. It represents a cottage with a colonial front, surrounded by a yard and a panel fence. Every detail of this truly admirable piece of mechanism is complete and correct. It seems almost impossible, even to a man experienced in the secrets of Mr. Galvin's craft, that it could have been produced, intact and entire, at a single casting. No molder who has examined it has been able to solve the riddle of Mr. Galvin's discovery in the line of castings.

The base of the design measures 8½ inches by 6½. The fence is eight inches by six, and one inch in height. The posts, panels, etc., are worked out with as much care as if the model were of large size. The house proper is 3¾ inches long, 3½ inches wide, and 3¼ inches in height. There are three sets of steps, three doors, six windows, three rooms, three chimneys, and a dormer opening in the attic. The house is not solid, having an interior as perfect and symmetrical as the exterior. Even the air spaces in the garret above are worked out with a fidelity that is wonderful.

Mr. Galvin is a well-to-do citizen and popular artisan. He is connected with a large local foundry and repair shop in a responsible capacity.



AN ODD CASTING.

How Edison Perfected His Storage Battery.

The writer of this lives near Edison's laboratory and is in a position to know something of what is going on there. We believe that very few inventions have been so thoroughly worked out and perfected before being offered to the public as this one. Not only once but repeatedly, within the long term during which

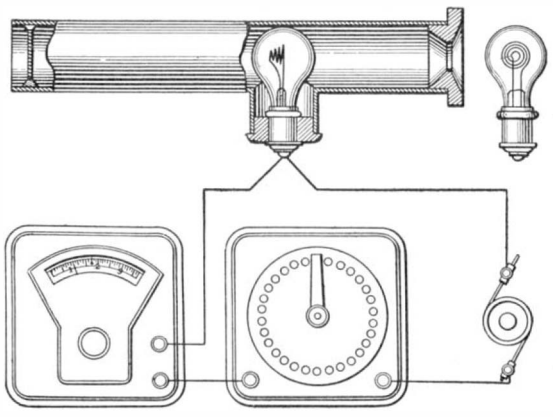


DIAGRAM OF THE THERMO-GAGE.

Edison has been working on this battery, his associates in the laboratory have been quite satisfied with it—have believed it to be practically perfect and have urged him to begin its manufacture for the market. But he has until now persistently declined—invented some new and apparently needlessly severe test for the battery; and in every case where any weakness whatever has developed even under extreme tests, not likely to be met with in practice, has gone to work again with inexhaustible patience and persistence to overcome such point of weakness.

Edison set out to remedy all these defects (of the lead cell). His battery is considerably lighter for a given power—uses no lead; power can be taken from it rapidly without injury—it has been short-circuited—and immediately afterward found in good working condition; it can be charged much faster—power for a forty-mile run for an ordinary car can be put into it in an hour without injury; it can stand idle indefinitely without deteriorating; it uses no acid.

These results have been attained by what we know to have been a very exceptional and thorough process of step-by-step invention in which expenditure of time and of money have been literally disregarded—disregarded to an extent not possible with most inventors.

These batteries have been put into all sorts of standard electric vehicles and run—by men knowing absolutely nothing about them and only how to work the levers—over all sorts of roads, up hill and down, in all sorts of weather. A battery has been rigged up on a jack out in the yard of the laboratory so that whenever the power was running—about ten hours a day—it was continuously raised up and let fall upon some logs; this was kept up for months to study the effects of far more severe jolting than can be given to it in service. A battery, after having its more delicate electrical connections taken off, was thrown out of a third-story window of the laboratory and then with nothing else done to it except put on the electrical connections, it was tested and found to be efficient. The men driving the experimental vehicles or, rather, the standard vehicles equipped with experimental batteries, were repeatedly given directions to start out and take every right-hand turn for seven turns regardless of the road or where it led to, and then home again. These men drove the vehicles every day for many months and purposely gave them the most severe possible tests. In short, we know whereof we affirm when we say that it will scarcely be possible for any user to give one of these batteries as severe a test as they have received.—American Machinist.

Conditions Governing Entries in United States for the Gordon Bennett Cup Race.

The Automobile Club of America is open to receive entries for the cup race, upon the following conditions:

1. Each entrant shall deposit with this club the sum of six hundred dollars.

2. The racing committee of this club shall decide which of the entrants may compete in the cup race. This decision may be arrived at by a contest, or by the committee without a contest.

3. Any entrant who is not nominated by the racing committee for the cup race shall have his entrance fee returned to him.

4. Any entrant who, after being nominated for the cup race by the committee, does not start, shall forfeit his entrance fee of six hundred dollars.

5. If three entrants are nominated to take part in the cup race, each entrant shall have two-thirds of his entrance fee (after deducting his proportion of the expenses incurred in holding the race) returned to him, provided he starts in the race.

6. If two entrants are nominated, each of such entrants shall have one-half of his entrance fee (after deducting his proportion of the expenses incurred in holding the race) returned to him, provided he starts in the race.

7. These rules are supplemental to the rules of the Gordon Bennett cup race, by which each entrant agrees to abide.

Accidents to the Lebaudy and Langley Flying Machines.

Accidents which have lately occurred to the Lebaudy airship and the Langley aerodrome (described respectively in our issues of December 5 and October 17) have shown the weak points in both the "lighter than air" and the "heavier than air" types of flying machine. The Lebaudy airship came to grief on November 21, by being driven against some trees when making a landing, while the Langley aerodrome was again launched over the Potomac River on December 8, with the result that it darted upward, described a circle, and plunged into the river, striking bottom and being afterward pulled with difficulty out of the mud, whence it came in a demolished condition. Mr. Manly, the operator, fortunately escaped with a wetting. The accident was laid to the failure of the launching apparatus to work properly; but as the reports state that the machine shot straight forward some yards before darting upward and turning a somersault, it would seem as if the launching apparatus was not so much at fault as that the operator was unable to control the aeroplanes, or, at any rate, to control them quickly enough to avoid disaster. This accident has put an end to Prof. Langley's experiments for the year, and it has again demonstrated that a flying machine constructed on the aeroplane, or "heavier than air," system, is an exceedingly difficult thing to control. The Lebaudy disaster, which will be found illustrated in the current Supplement, has shown the weaknesses of the airship type of flying machine, should a moderate puff of wind occur at an inopportune moment, when a landing is being made.

The Largest Public School.

A new school is to be erected in Hester Street, between Essex and Norfolk Streets, and facing Seward Park, New York, which will be the largest in the world. It will occupy 200 feet on Essex Street, the same on Hester Street and 75 feet on Norfolk Street. The height, six stories, exceeds that of any present school. There are to be a basement and sub-cellar, and in the basement will be an auditorium capable of seating 1,600. The school will be able to accommodate about 4,500 pupils. Altogether there will be 124 classrooms.

The building will be practically two schools, one for boys and the other for girls. The entrance for the girls will be in Norfolk Street and that for the boys in Essex Street.

On the sixth floor will be a gymnasium, cooking room, workshop, two baths, lockers and seven classrooms. The exterior of the building is to be of buff and blue Indiana limestone and the interior will be finished in oak. It will be the first school in this city to have elevators to carry the children to the upper stories.

Each fruit grower of New York will be furnished with a padded barrel by the State Commission to the World's Fair. The barrel will be packed by the grower and shipped to the Fair at State expense.

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A SECTIONAL STEAMER FOR OUR COLONIAL POSSESSIONS.

(*Continued from page* 460.)

notice wherever the transport happened to be. These conditions necessitated further development of the sectional boat, to make it practical for assembling, with the members afloat, or when put overboard separately by the ship's derrick. The department issued a call for bids, stipulating the requirements, and leaving it with the bidders or builders to make their own plans and specifications, and to rely on their own ingenuity to fulfill the contract. The proposal coming from one of the New York yards, the Gas Engine and Power Company and Charles L. Seabury & Co., Cons., at Morris Heights, N. Y., was accepted. The different members of the sections, with the varying size and weight, and the weight of the equipment they carry, must naturally have different displacements when put afloat, and be brought to a common waterline before attaching to each other. They must be quickly assembled, and under great difficulty at times when the sea is rough; they must also have sufficient strength to at once become capable of operation, and to stand the strain of the waves, with their own weight. In the length over all she is 80 feet; beam, 18 feet; draught, 3 feet 6 inches. A light draught is essential, as the greatest advantage would be realized in her use for embarking and debarking men, munitions, etc., in waters which would not be navigable for vessels of great draught. With a full load her displacement will be 72 tons, on which the draught is calculated. She is of steel construction throughout. With the steel deck each member becomes watertight or boxlike in form. The bow section is comparatively short, carrying derrick and the anchor equipment, with chain and store lockers inside. The quarter section, or that next to the bow section, serves both as a hold for the cargo and as quarters for the crew; in fact, will berth twenty men if required. The third section carries the boiler, the coal bunkers, and a portion of the water storage. Her coal capacity will be thirteen tons, giving her a liberal running radius. On the top of this third section is also fitted a pilot house (portable), with or without which the vessel may be operated. The section next aft the boiler, or fourth section, will carry the driving power intact, that is, the two engines, for she will have two, their shafts, and the propellers, thus keeping them in perfect alignment and without danger of being disturbed. A portion of this section, measuring 11 feet 6 inches fore and aft, is cut off with an inside bulkhead to give quarters for the officers. The boiler is of water-tube pattern, and her engines two-cylinder or compound, measuring 6 inches and 12 inches and having piston stroke of 9 inches, capable of giving her a speed of ten miles per hour. The fifth section composes the oval counter, which may or may not be used. As this section comes above the waterline, its omission gives the vessel a square stern effect.

When putting the vessel in commission, the boiler section will first be floated, having the greatest weight and establishing the waterline, and the others may follow in order, working either fore or aft. They are fitted with sea valves, and sea water is admitted into their bottoms until they reach the common waterline. Two sections coming together have their ends fitted with cones of about 14 inches diameter, one set pointing inward, the opposite pointing outward. On the deck of each section is fitted a small windlass with a steel cable which works on a differential system. The cable connects cones of one section to the other, and the windlass being operated, brings the four cones together, one from each section engaging that of the one adjoining. When all have been secured, the water ballast is removed by steam siphon connection, and they are reinforced by connecting bolts, one section to the other. The boat is now ready for use as soon as the steam connection between the engine and boiler sections can be coupled, and the piping for the water feed connected to the pumps.

When required to be taken apart for reloading on transport, the operation is simple, involving only the breaking of the steam-pipe connection, removal of bulkhead staybolts, and relaxing of the cables holding the cones, to disengage them.

The contract provides that a demonstration shall be made prior to acceptance, to prove the practicability of the scheme, and after this has been given official attention, the vessel will be sent to Washington, where she will be used temporarily for drilling, until assigned to one of the transports.

The fact that 75 per cent. of the central electric stations of the United States are in places of less than 5,000 inhabitants, as compared with 22.8 per cent. of the gas plants, indicates the wider distribution of the electric stations which have enabled the inhabitants of the small places to enjoy illuminating facilities confined heretofore to the larger cities and towns.

Correspondence.

Palmetto as a Source of Cellulose.

To the Editor of the SCIENTIFIC AMERICAN:

Your exhibit of facts of the material of the paper trade in issue of November 14 was as valuable as it must be interesting to thousands of readers.

I remember reading recently that the only reason why palmetto in Florida was not used for pulp for paper was because there was no water power there to use in its conversion.

I am very familiar with that State, and I know of *only one* water power in the State possible or feasible. That one is in its wild state, and surrounded by thousands of acres of native palmetto, which grows up and falls down annually, unused.

DR. J. H. MCCARTNEY.

Rochester, N. Y.

The Flight of Birds.

To the Editor of the SCIENTIFIC AMERICAN:

The very interesting articles in your good paper upon the flight of birds lead me to mention a fact not noted by any writer whom I have read. In collecting bird skins I have found innumerable air cells, forming a most delicate and wonderful network, between the body and the skin. In the pelican, one of our largest birds, this network of cells practically covered the whole body, and was very noticeable. Now if these cells work automatically, like the lungs, or like the circulation of the blood, being filled with or emptied of hot air, according to the purpose of the bird to rise, float, or descend, then surely we can better understand the ease with which birds seem to sustain themselves in the air during their long flights.

Passumpsic, Vt. C. D. R. M.

Compressed Straw for Fuel.

To the Editor of the SCIENTIFIC AMERICAN:

While driving through the country a few days since, my interest was aroused by observing the scores of straw stacks just now standing all over the wheat country. Much of this straw will be burnt where it stands, the only way at present of getting rid of it. Could not some better use be made of it? Has no portable machine been devised which would cheaply convert this straw into compressed fuel, right on the farmer's premises, and thus save a large quantity of wood, which is often none too plentiful?

If such a machine is in existence, I would esteem it a favor to be put into communication with the makers. If not, perhaps the problem will commend itself to some of your readers. H. READER.

Kutawa, Assa., N. W. T., Canada, November 10, 1903.

Yellow Fever in Cuba.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN for October 31 or November 7, 1903, under "Notes," I noticed a statement that by good sanitation, etc., Cuba was *gradually* reducing the number of cases of yellow fever within its borders. This is a misstatement that is absurd to those who have read the medical literature of the last few years and is unfair to Cuba and to the United States army medical officers who helped free Cuba from yellow fever.

Not a case of yellow fever has originated in Cuba since three years ago last September. Occasionally a case is brought here from Mexico, but the patient is at once isolated, and in no case for over three years has the disease spread to others. So Cuba can be said to be entirely freed from yellow fever.

WESTON P. CHAMBERLAIN,
Capt. and Asst. Surgeon, U. S. Army.

Cabana Barracks, Havana, Cuba, November 10, 1903.

Radium and the Laws of the Conservation of Energy.

To the Editor of the SCIENTIFIC AMERICAN:

S. W.'s question, reprinted from Nature in the last issue (Nov. 7) of the SCIENTIFIC AMERICAN without comment, shows the popular confusion of *force* and *energy*. The magnet will attract and hold a certain definite and determinable amount of magnetized metal, and thereby does a certain amount of work, but this done, the magnet has exhausted its power for the time being, until by doing *work against* the magnetic force, by gravity or muscular effort or otherwise, the "unsatisfied affinity" is again operative. When simply reposing in a drawer, it is parting with as much energy as a book lying on a shelf ready to fall to the floor when gravity is allowed to act on it.

Radium, however, is continually giving off heat *without apparent loss* or change, an output sufficient to melt a considerable amount of ice hourly and to *maintain* this rate. It is doing work without apparent signs of weariness, and its disregard of the otherwise established principle of the conservation of energy is what is puzzling the whole scientific world. As to odors, which are extremely delicate tests for the presence of substances, the usual theory, while not absolutely proved, is by no means unreasonable, for the smallest weighable quantity, say 0.01 milligramme, must contain a vast number of molecules, a few of which may well affect our sensitive nerves of smell. It would hence require long periods of time for perfumed substances not noticeably volatile to lose an appreciable amount of weight, and from a closed vessel even ether will not find its way out very rapidly. A solid like camphor, which possesses a strong odor and a high vapor tension, rapidly wastes away in air, but can, of course, be preserved indefinitely in a closed space. ARTHUR D. WYMAN.

Cambridge, Mass.

Optical Atmospheric Phenomena.

To the Editor of the SCIENTIFIC AMERICAN:

The writer once observed a sunset in Iowa which he wishes to describe as he saw it, not only on account of its singular beauty, but also because it furnished the key to the explanation of a piece of natural scenery which had often puzzled him, and the cause of which he had never seen accounted for.

No one can have failed to notice the fan-shaped rays which, at the time of sunset, sometimes, from the sun as a center, shoot up against the sky. Such rays now ascended likewise on the occasion here referred to; but in the place of fading out at some little distance from the horizon, they ran on, growing wider and wider until they passed over the meridian. Thence gradually contracting, they took their course over the eastern hemisphere, and on the eastern horizon centered in another point just opposite the setting sun. As light rays seemed to ascend from the western center, thus from the eastern point of meeting, to all appearance, dark rays arose, until the two systems met and blended in the meridian. The rich yellow and orange of these stripes, mottled in places with tiny clouds, made the sky look like one gigantic melon, and presented a spectacle as gorgeous as it was unique.

Suddenly it occurred to the writer that these rays were cylindrical highways of light, which ran across the sky horizontally (parallel to the surface on which he was standing), at a considerable elevation over his head, and which (like a straight road in the line of vision) owed to perspective their peculiar appearance. They were caused of course by the transmission of the setting sun's light through apertures in the clouds near the horizon. JOHN NOLLEN.

Pella, Iowa.

Canal Locks.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of October 10 I was very glad to find some data of the new hydraulic canal locks at Peterboro (Ontario). But there were some misleading expressions, and I hope the following facts will also interest a great part of your readers.

At first I must state that the new locks are not the largest in the world, and then there is *not* only one such lock in the world; there are still three locks built after the same principle, i. e., locks supported by a single piston in a cylinder with compressed water. The first one, at Anderton (England), connecting the river Weaver with the Trent and Mersey Channel, was built as early as 1875. Its dimensions are given below.

Two others, at La Louviere, Belgium, and at Les Fontinettes, France, were built in the years 1880-1888; their dimensions are also given below. The hydraulic lock in Germany referred to in your article is built on quite another principle; for the weight of the pontoon filled with water and its supporting structure is counterbalanced by the buoyancy of five swimming tanks, moving up and down in great pits, filled with water and supporting five turrets on which rests the pontoon. The movement is produced by means of four screws, fastened in turrets at the corners of the pontoon and driven electrically, which are connected with the pontoon by four nuts fastened to it in such a way that they will move up and down as soon as the screws are moved by an electrically-driven gear. The dimensions of this lock are given also in the following table, and will show that this is the largest lock in the world. It is situated at Henrichenburg, near Dortmund, in the famous Dortmund-Ems Canal, and was built in the years 1894-1899 by Hanil & Lueg from Düsseldorf and Harkort from Duisburg. The electric plant is from Lahmeyer, Frankfort-on-Main.

Lock at—	Anderton.	La Louvière.	Les Fontinettes.	Henrichenburg.
	Meters.	Meters.	Meters.	Meters.
Distance between water levels	15.35	15.4	13.3	14-16
Length of pontoon	22.85	43.2	40.60	70
Breadth of pontoon	4.75	5.80	5.60	8.8
Depth	1.35	2.40	2.00	2.50
Diameter of lifting piston	0.915	2.00	2.00	5 x 10
	Tons.	Tons.	Tons.	Tons
Capacity of vessel to be lifted	100	360	300	750

K. A. MULLENHOFF, Engineer.

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THE OPENING OF THE NEW EAST RIVER BRIDGE.

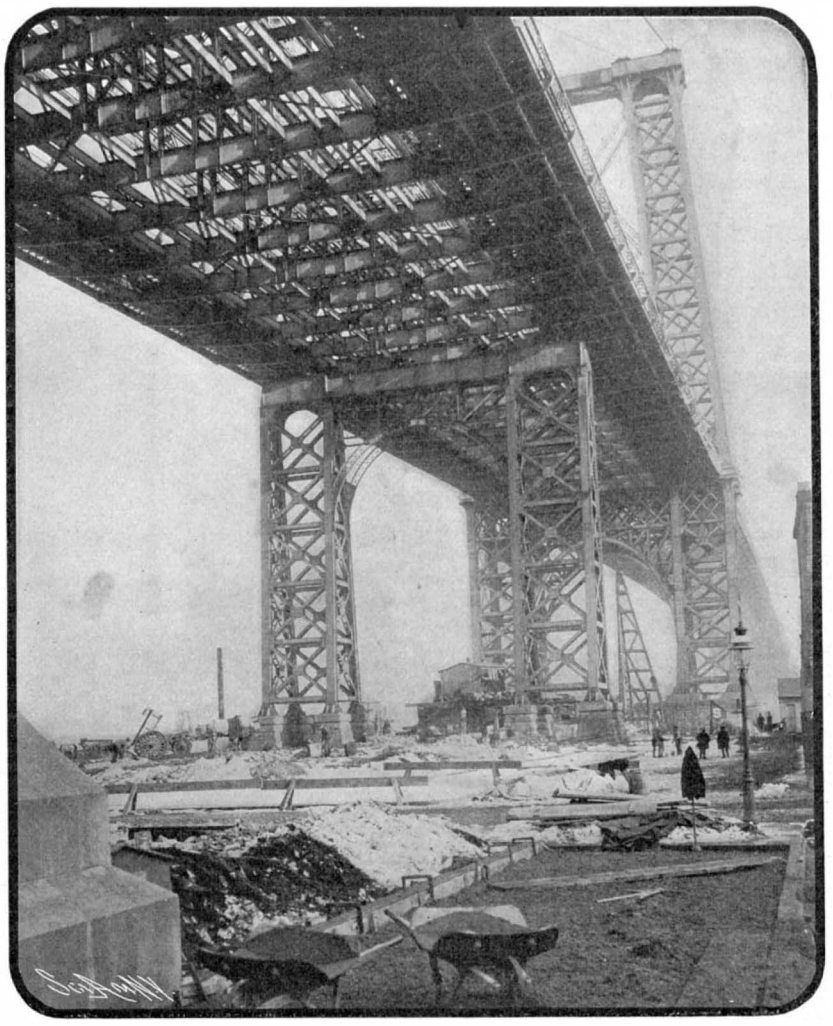
By a curious and fortunate coincidence, it has fallen to the lot of the gentleman who as Mayor of Brooklyn had the honor of opening the Brooklyn Bridge some twenty years ago to perform the same ceremony as Mayor of Greater New York for the new East River Bridge. The opening of the bridge, which took place on December 19, is an event of such importance that we have published contemporaneously with the present issue a special edition of the SUPPLEMENT, in which the progress of the bridge, from the sinking of the foundation to the completion of the structure, is described and illustrated in very full detail. At the same time, we present herewith an entirely new set of views of the completed structure, which have been taken specially for the present issue.

The new bridge is the widest, the strongest, if not the most handsome of the large suspension bridges of the world. Its entire length between terminals is 7,200 feet, the length of the main span, center to center of towers, is 1,600 feet, and the extreme width of the floor, from railing to railing of the outside sidewalks, is 118 feet. The next largest suspension bridge is the famous structure a mile and a half down the East River, which is 1,595½ feet between towers, 3,455 feet long between the anchorages, and 5,989 feet over all. It is in the great width of the floor and number of railway tracks carried that the new bridge exceeds the older structure. The present bridge is only 85 feet wide as against 118 feet, and carries only four tracks as against six. The new bridge, moreover, having the advantage of later improvements in the materials and methods of bridge building, will be a much stiffer and, relatively to the loads it will carry, a much stronger structure.

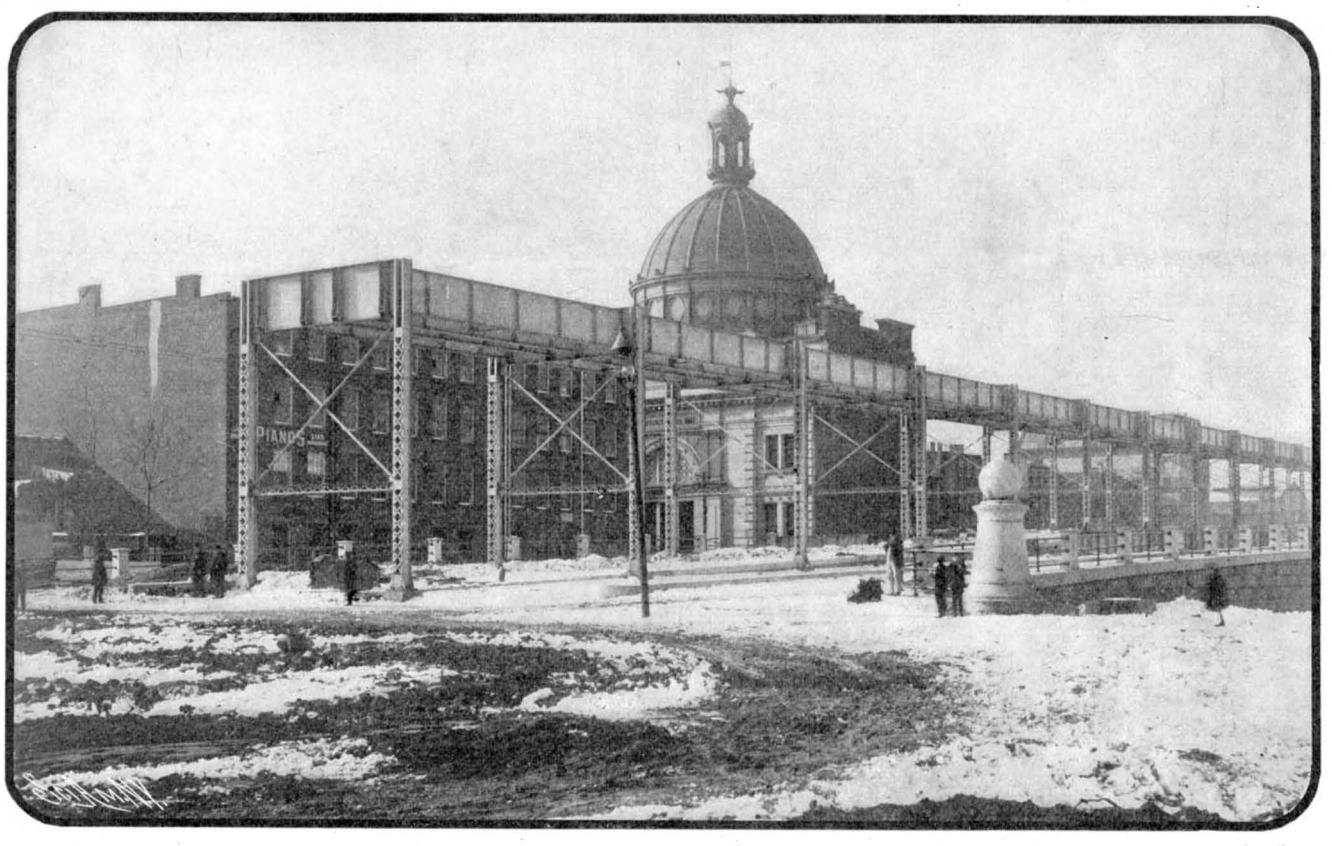
The foundations of the towers are timber and concrete caissons sunk in every case to bedrock. Above these are solid masonry piers, two for each tower, which are carried up to 23 feet above high water. Upon each pier, one at each corner, are laid four massive pedestal blocks of dressed granite to form the footings for the four legs of the towers. The towers consist of four corner posts or legs strongly braced together, the two groups of four on each pier being connected by massive transverse lattice trusses and diagonal ties. The tops of the towers are 335 feet above the river and 442 feet above the lowest foundation. The center span is carried upon four 18-inch steel wire cables which extend inshore 590 feet, where they are anchored to masonry anchorages. The inshore portion of the cables does not, as in the Brooklyn Bridge, carry the shore spans, but the latter are supported by the tower, the anchorages, and an intermediate pier.

A further point of difference from the Brooklyn Bridge is the method of stiffening the floor against deformation. In the Brooklyn Bridge this is accomplished by six shallow trusses assisted by a series of stiffening cables running from the panel points of the trusses to the tops of the towers—an unsatisfactory and unscientific arrangement, as the buckling of the trusses has more than once proved. In the new bridge stiffness is imparted by two continuous lattice trusses 40 feet in depth and of great solidity. At each panel point of the trusses a deep plate-girder floorbeam, reaching clear across the floor, is riveted to the trusses. The stiffening trusses are 67 feet apart, and to support the floorbeams at the center, vertical ties are carried up from two points on the floorbeams to connect with light transverse trusses which connect the stiffening trusses overhead.

The new bridge has no terminal stations, the purpose being to provide a broad, continuous thoroughfare over which trains, vehicles, and pedestrians may pass without any interruption, the bridge thus forming a part of the street system of Greater New York.



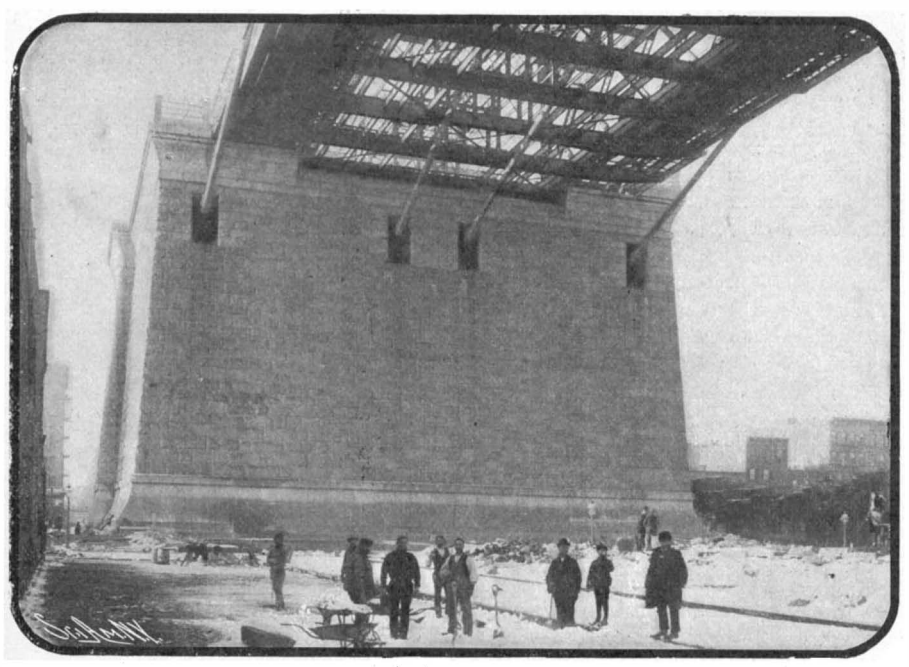
Pier Between Tower and Anchorage, Carrying Shore Span.



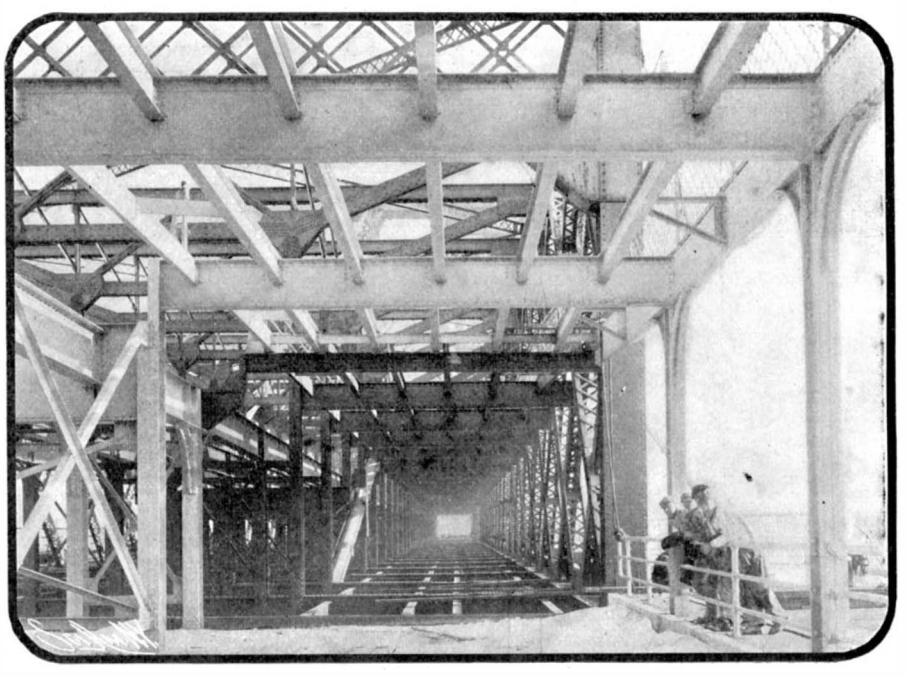
Entrance of Brooklyn Approach, Showing the Elevated Structure.

Sea Water for Street Sprinkling.

Although sea water is more effective in damping down dust on macadam roads than fresh water, in Hastings, where it has been used for street watering, objection has been taken to it on the ground that it injures the varnish on carriages, while the tradesmen complain that the salt-laden dust from the streets affects articles of food exposed for sale, thereby endangering public health.



The Brooklyn Anchorage.



The Roadway for Two of the Six Railway Tracks.

THE OPENING OF THE NEW EAST RIVER BRIDGE.

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ORNITHOLOGICAL DISCOVERIES ON LAYSAN.

BY HAROLD J. BOLCE.

Naturalists commissioned by the United States government have discovered on the distant island of Laysan in the Pacific some new birds, and many novel facts in regard to known species. The visiting scientists were perhaps the first human beings whom the myriads of birds that crowd this tiny speck of land had ever seen. In consequence, the visitors enjoyed an experience unusual in modern adventures. Birds representing species which in other lands wing hurriedly away at the sight of man, came up to the naturalists, looked curiously into their faces, perched on their writing tables, wonderingly inspected the tripod and other accessories of the cameras, and permitted themselves to be stroked.

The fact that these birds are ordinarily regarded as the wildest kind of species made a profound impression on the visiting scientists. "Wherever we went," said Walter K. Fisher, who under Dr. Charles H. Gilbert directed the Laysan expedition, "we were free to watch and learn, and were trusted by the birds. It was a most touching and unique experience, and one which demonstrates all too forcibly the attitude of wild creatures which have not yet learned that man is usually an enemy."

Whenever a nest of white tern was approached, the birds would come and hover in front of the explorers. They would peer intently into the faces of the naturalists, as if attempting to discover the purpose of the unusual intrusion. Among the odd instances of lack of fear on the part of these birds of Laysan, was the action of an albatross, which came up and peered into Mr. Fisher's face and, finding that he was disposed to be friendly, began to make a critical examination of his camera. Many of the young birds of this species on the island permitted themselves to be stroked, and soon acted as if they had been reared as pets, so friendly and confiding were they. The little miller-bird would come and look over the manuscript which the naturalists were preparing on a table, and when the men dined, the Laysan finch and rail walked about their feet, industriously searching for any crumbs that might fall.

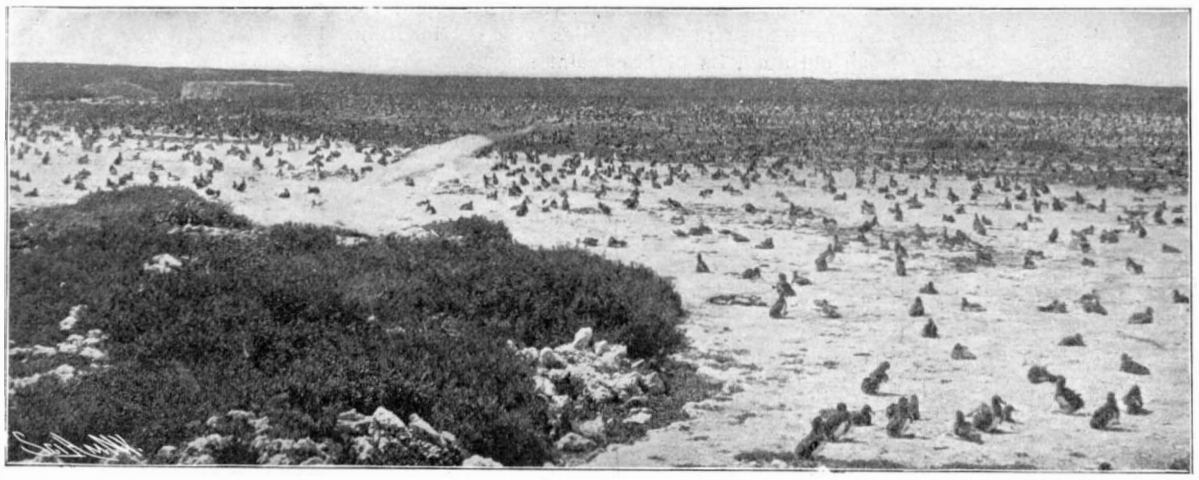
The Laysan rail (*Porzanula palmeri*) was found to be the most confiding bird among all those that were encountered. It was possessed of a great amount of curiosity to fathom the mystery of the scientific expedition. A scientist had a curious experience while photographing a nest of one of these birds. He propped back a mass of juncus stems which concealed it, and stationed his camera not more than two feet away; but while he was in the act of focusing the instrument, the bird fearlessly stepped into the nest and began to cover herself with the lining of soft fiber. She was photographed several times, and was then bodily lifted off the nest and carried some distance, and an attempt was made by flaring the camera cloth in her face to frighten her away. She retired a moment to some neighboring grass, and the naturalists hastened back to the camera, but when they turned around they beheld the rail skipping rapidly back, and before a photograph could be had, she was calmly seated on her nest again.

It was not only the marvelous gentleness of the birds of Laysan, which had not yet learned of the aggressiveness of man against their kind, that impressed the naturalists, but also their astounding abundance. Small as this island is, it furnishes an asylum for uncounted millions of birds. Their combined cries and minstrelsy make such a deafening chorus that if the naturalists wished to converse, they found it necessary to shout at one another.

So dense is the bird life on this little island, that the various species have economized space by building their nests one above the other, and the scientists say that the similarity of these tiers of nests to the flats in tall apartment houses is quite marked. For example, the petrel and the wedge-tailed shearwater live in burrows which compare with an apartment house basement. Above them dwell the gray-backed tern and the sooty tern. Higher still in bushes the red-tailed tropic bird and the Christmas Island shearwater have their apartments. Higher still in shrubs the Laysan finch and the miller-bird build their homes. The loftier branches of trees are filled with the red-footed booby, the man-o'-war bird, and the Hawaiian tern.

The naturalists frequently crushed through the roofs of the petrel burrows, sinking to the knees in these subterranean bird homes. It was necessary in walking about to exercise great care, lest nests and eggs and young of all sorts of birds be trampled upon. Nesting room is at a premium, and every available inch in the island is pre-empted by some species. A curious thing is that these birds seem to understand that certain sections are allotted to them by inherited custom.

The lines of demarkation separating the bird colonies on the island are clearly fixed. Even related species, although near neighbors, do not nest in each other's territory. Thus the sooty tern (*Sterna fuliginosa*) inhabits an upper slope extending clear around the island, while the gray-backed tern (*Sterna lunata*) occupies a narrow strip near the beaches. Likewise the



A Large Colony of Laysan Albatrosses, Mostly Young Birds.

A Laysan Finch.

Customary Activity Over a Large Colony of Sooty Terns.

Mr. Fisher Studying the Albatrosses of Laysan.

A "Nest" of Gygis, the Bare Limb of a Chenopodium Bush.

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white albatross has secured title to a large part of the island, while the black-footed albatross confines its home to the sand beaches. The blue-faced booby (*Sula cyanops*) confines itself to a narrow, littoral sedge-covered slope. In fact, every species has a definite district. Thus horizontally and perpendicularly, the birds of Laysan are distributed, the boundaries of their cramped nesting places being fixed as if by statute.

It was found that on this little island, crowded with birds, the white tern deposits its one egg in a shallow cavity on the edge of a shelf of a rock. It would seem that with all the bustling bird life these eggs would be brushed off and destroyed, but such was not the case, although some of the eggs were balanced at the very brink of little escarpments.

The naturalists paid special attention to the subterranean bird homes. Those tunneled by the white-breasted petrel (*Aestrelata hypoleuca*) are no less than six feet in length, and are crowded side by side. Those made by the wedge-tailed shearwater (*Puffinus cuneatus*) are frequently three feet long and often very much deeper.

The study of these excavated nesting places revealed the fact that they are very ancient. Year after year they have served as breeding homes for these birds. Laysan is in such demand as a bird home, that one species of migrants no sooner departs than another flocks in to take its place, and the times of departure of one kind and the arrival of another are as precise as the movements of planets.

Although the apartment-like arrangement of nests enables the birds to make the best possible use of the island's area, Laysan would be utterly unable to contain all the birds that have chosen it as their breeding home if they arrived at the same time. "To find satisfactory places," said one of the scientists that explored the island, "the birds are obliged to take turns." Some species leave the place as soon as their young are strong enough to fly, and while they are in the act of departing, newcomers begin to arrive to take their places. "In this way," said the scientist, "a most definite succession, which probably dates back thousands of years, takes place year after year in the arrival and departure of certain species." Such is the law and custom in this bird Eden which, until now, so far as is known, has been uninvaded by man.

Whenever the naturalists fired a shot from a gun, thousands upon thousands of birds would suddenly fly about, crying out in a pandemonium of protest against the disturbance. Although the prevailing spirit of the teeming bird life is one of comity, there are some exceptions. A notable one is that which accompanies the arrival of the white-breasted petrel. These birds migrate by the thousand to Laysan, their habits on land being strictly nocturnal. Immediately upon their arrival they take possession of their ancestral catacombs, but not without quarrels and contests, and so rampant are these petrels, that milder species expediently move out of their way. The clamor of the petrels issues from under every bush and bunch of grass on the island. Even from under the sleeping place of the naturalists came the querulous notes.

The Hawaiian tern (*Micranus hawaiiensis*), a handsome little bird, lives exclusively on fish, yet it never dives for its food. It hovers over shoals of noi, and when one nears the surface, the tern swoops down and seizes it. Its fishing habits make this bird valuable to fishermen. It travels some distance to sea in search of its favorite diet. By following it, fishermen are enabled to locate the whereabouts of great schools of fish.

The white tern (*Gygis alba kittlitzi*) has the curious habit of never bringing less than two fish at a time to its young. It carries the fish crosswise in its bill, and sometimes returns from its excursions with no less than four fish thus carried. It was easy enough to understand how it captured the first fish, but the naturalists were unable to comprehend how the bird managed to retain it while securing additional ones. Its ability to hold three fish in its bill and still capture a fourth was particularly puzzling. This bird is strikingly beautiful, its plumage, with the exception of a black orbital ring, being pure white.

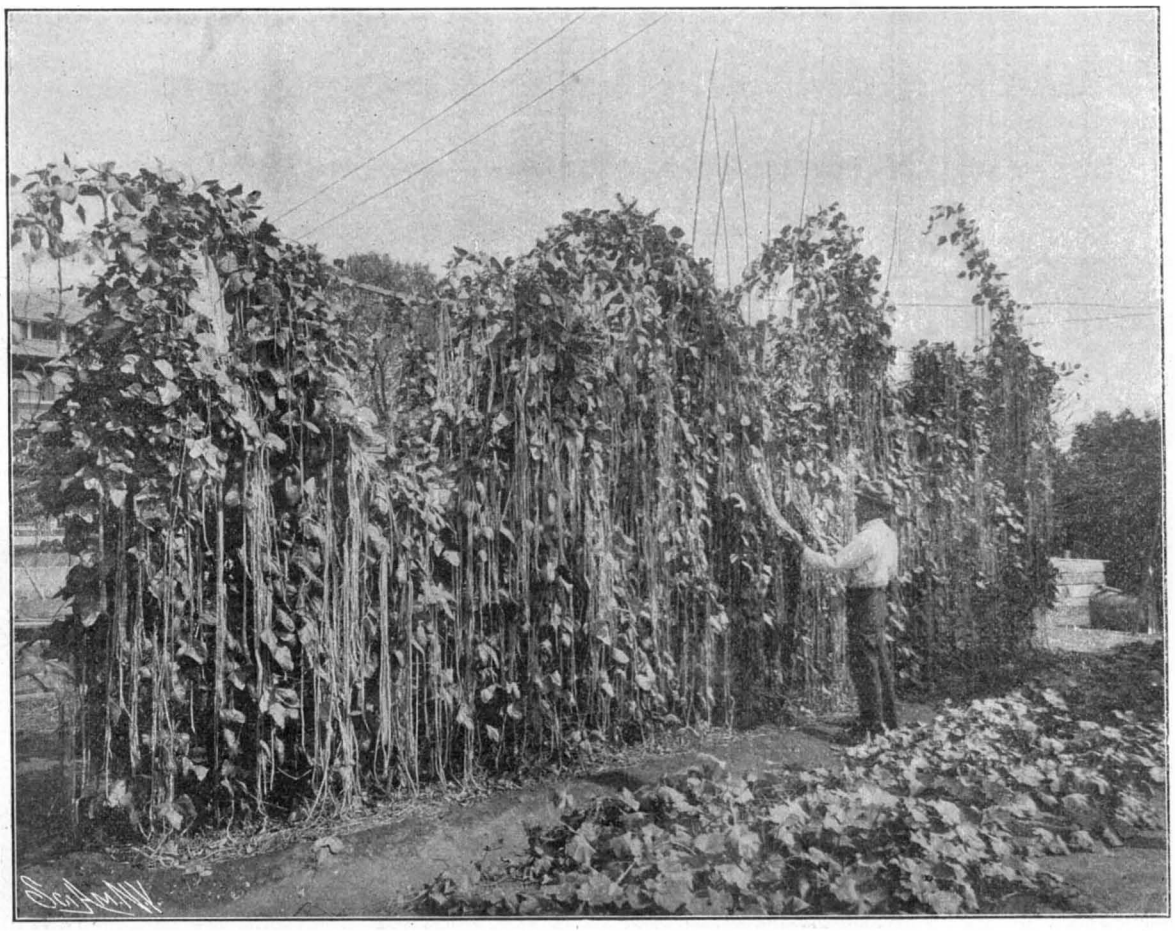
The expedition resulted in the discovery of a new species of tern, which Mr. Fisher has called *Procelsterna saxatilis* because it lays its eggs in hollows among the rocks. A peculiar species of teal was found on Laysan. Although ducks are regarded as the wildest kind of fowl, these Laysan teal would come up to where the naturalists stopped at nightfall, and would walk about like barnyard fowl.

Mr. Fisher has prepared for the government a fascinating account of the dance of the albatross, which he witnessed on Laysan. This account was published in the last number of the SCIENTIFIC AMERICAN, and need not here be repeated.

The island of Laysan, where these interesting observations of bird life were made, lies in latitude 25 deg. 42 min. south, and is 800 miles west of Honolulu. It is an old atoll, its highest point above the sea not exceeding 30 feet. It is but three miles long and one and one-half wide, and although it belongs to the United States, has escaped attention until now.

CALIFORNIA STRING BEANS.

The largest string beans in the world may be seen growing in the gardens of Charles Richardson, in Pasadena, Cal. They range from thirty to forty-three inches in length and average half an inch in width. They are not only enormously large but they make a delightful table delicacy when cut and stewed and prepared with cream and butter. The commercial gardener would find them a most profitable production, for the vines bear profusely and the beans are so large that one of them is more than a single person can comfortably manage.



TEN THOUSAND YARDS OF BEANS ON A THIRTY-FOOT ROW.

These beans are of an aristocratic species and do not claim alliance with the common string bean. California botanists class them as belonging to the genus Dolichos, but owing to their great length they are more popularly known as "yard beans." The plants are natives of China and Japan and the seeds were sent to Mr. Richardson from Japan.

Early in the spring he planted them in a well-spaded, well-fertilized trench and put up a trellis seventeen feet in height to support the vines. The seeds sprouted quickly and the plants began to grow with a vengeance. They climbed to the tops of the poles and then turned around and began to grow backward. They are now twenty-five feet in length and are still growing. The row is thirty feet long, contains fifty vines and it has been estimated that the crop amounts to ten thousand yards of beans. The beans grow in clusters and can be easily and quickly gathered. The fragrant lavender blossoms resemble those of the sweet pea. They are peculiar in their habits, living but for a day, opening with the sun and dropping their petals when the sun goes down. The leaves are long and wide and grow in clusters of three. The vines are very clean and attractive and would be decidedly ornamental in any summer garden for either fence or trellis covering. The beans are best for eating when about twenty inches long. In flavor they excel that of the ordinary string bean.

Experiments on White Lead and Zinc Paints.

Apropos of the proposed substitution of paints having zinc white or other zinc compounds as a base, for white lead paints, M. J. Breton, a French scientist, has lately made a series of experiments upon the relative merits of different paints. He submitted a series of paints whose base was white lead or oxide of zinc to different actions and attacked them by strong reactive agents. From these experiments he brings out the following facts: White lead resists the action of certain acids better than its substitutes, but on the other hand it is quite inferior under the action of heat, of sudden changes of temperature, also of hydro-sulphurous emanations and certain strong oxidizing agents such as hypochlorite of soda. Besides, the white lead paints are much less adherent to the surfaces to which they are applied and have a marked tendency to blow up. The addition of sulphate of barium to white lead, while it diminishes its covering power considerably, does not seem to render the paint any less resistant. The addition of siccative to zinc oxide in the proportion needed to give these paints a drying quality which is equal to that of the white lead paints, does not diminish the resistance of the paint and appears on the contrary, at least in certain cases, to increase its solidity. The white lead forms a simple mixture with linseed oil, and not a combination, and the mixture is less homogeneous than that which is formed by oxide of zinc.

By a series of different methods which give very concordant results M. Breton compared the covering power of white lead and zinc oxide. He found that for an equal weight the spreading capacity of the zinc oxide is nearly double that of the white lead. For equal volumes, the covering power of zinc oxide is superior to that of the white lead, but as for equal quantities the first of these bodies forms a much less fluid mixture with the oil, it is necessary in practice to make the zinc paint thicker in order to obtain the same result. He shows that fresh white lead paint gives off emanations containing lead and which may in some cases bring about serious consequences to persons who are obliged to breathe them. This series of experiments forms a new argument in favor of substituting zinc for lead paints, which is so much to be desired from a hygienic standpoint, and presents so many advantages from a technical point of view.

Radium in America.

Prof. Alexander H. Phillips, of Princeton, is reported to have stated that radium exists in this country in carnolite, an ore from Utah. The professor found on experimenting that from twenty-five pounds of carnolite a sample of radio-active barium chloride can be obtained, which will give about 1,500 activity. This activity, while not so powerful as that obtained from some European ores, is sufficient for many practical purposes. A company has been formed to place this new substance upon the market, and it is expected that it can be produced in paying quantities.

Carnolite, while not a very common ore, is found in good quantities in Utah, and very likely in other places in the Rocky Mountains.

Premiums for Improved Methods in Manufacturing Varnishes.

At the third general meeting of the Association of German Varnish Manufacturers recently held in Berlin, the board of directors was empowered to offer premiums or prizes of several thousand marks for methods of manufacturing varnishes which involve noteworthy improvements. As an important subject for consideration, a method for the deodorization of oil of turpentine is mentioned. The jury for awarding prizes consists of the board of directors and four other members. Communications are to be addressed to Mr. Louis Mann, commercial judge, Berlin, W. Meinecke Strasse 4.

Actinium is a metal whose radio-active properties rival those of radium. As yet little, if anything, has been done with the substance in this country. Dr. George F. Kunz, Tiffany's diamond expert, is the lucky recipient of a minute specimen, which is to be used for therapeutical purposes.

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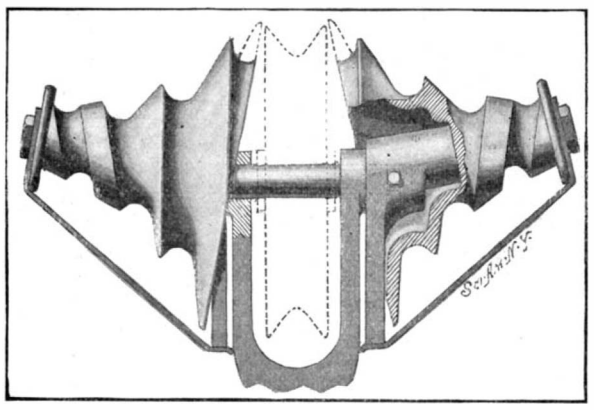
Patent Department

TROLLEY FINDER.

Many inventors have with more or less success directed their attention to the task of contriving some simple device which will either prevent a trolley wheel from slipping off the line wire, or which will enable one to readily replace the trolley wheel after it has slipped off. The invention which we show herewith practically covers both of these requirements; for should the trolley slip off to a limited distance on either side of the wire, the latter will be caught by a spirally-grooved roller and fed back onto the trolley wheel. This device also possesses the further advantage of having no parts projecting above the trolley wheel which might interfere with the free action of the trolley or the finder. The rollers which are adapted to feed the line wire back onto the trolley wheel, have approximately the form of a cone, and are mounted with their axes inclined upwardly from the trolley harp. The rollers are loosely journaled on studs, which are threaded into rocking frames supported on the projecting ends of the trolley shaft. In order to retain these frames on the shaft, the latter near each end is peripherally grooved to receive the squared ends of bolts threaded through the hubs of the rocker frames. The rocker frames are preferably connected to form a yoke, which spans the trolley wheel, and to the outer end of the yoke a guide rod is fastened, which runs parallel with the trolley pole, and is fastened at its lower end to the trolley pole stand.

Now, supposing the trolley should slip off to one side, the line wire would be caught at some point in the spiral groove of the roller on that side, and as the car continued to move forward, the roller would rotate, feeding the wire laterally and upwardly until it was replaced on the trolley wheel. The object of having the axes of the rollers inclined is to give clearance for the trolley harp, and also to reduce the incline up which the wire must travel. Normally, the rollers will, under the action of gravity, assume the position shown in our illustration, that is, with the largest radial projection hanging downward, so that no portion of the roller will project above the trolley wheel. If the wire should slip clear of the rollers, it is a very easy matter to bring some portion of the rollers into contact with it, when it would automatically be fed back to the trolley after the car was started up. A patent for



TROLLEY FINDER.

this invention has been granted to Messrs. F. A. Graham, F. F. Carmiencke, and J. R. Neely, Box 495, Muncie, Ind.

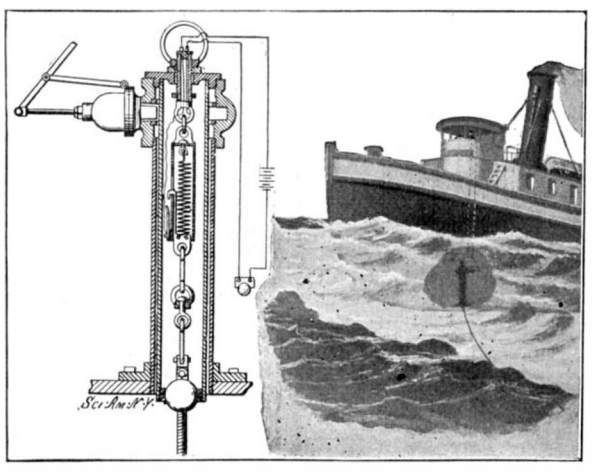
The Band Saw Is an English Invention.

The well-known English author of several books on woodworking machinery, Mr. M. Powis Bale, of London, takes issue with the Timber Trades Journal of the same city regarding the invention of the band saw, which was attributed by that publication to a Frenchman. He says:

"I notice that the invention of the band saw is attributed to M. Perin, of Paris. This is an error, as it was really the invention of an Englishman—one William Newberry, who, in 1808, patented a machine for sawing wood, in which an endless band or ribbon saw strung over two wheels was used. Owing to the difficulty, however, of obtaining saw blades that would withstand the strain put on them, the machine remained in abeyance for many years, till M. Perin, about 1855, introduced a much improved machine on which he used specially-tempered saw blades of French manufacture, and thus made the machine a practical commercial success. The early history of woodworking machinery is extremely interesting, and I would draw your attention to the marvelous patent specifications of Sir Samuel Bentham in 1791 and 1793, as they are truly remarkable examples of inventive genius, and fully illustrate the old adage, 'There is nothing new under the sun.' In these specifications the principles involved in many of the most important woodworking machines at present in use are claimed and set forth in the clearest and tersest manner, including planing machines with rotary cutters to cut on several sides of the wood at once, veneer cutting machines, horizontal saws, molding and recessing machines, bevel sawing machine, saw-sharpening machine, tenon cutting by means of saws, and many kinds of rotary and boring tools. Well may the disappointed inventor say, 'Those beastly ancients have cribbed all our best ideas.'"

SAFETY ALARM DEVICE FOR MARINE VESSELS.

With a view to making vessels independent of the ordinary sounding line, as an indicator of approach to shallow water, Mr. Marshall Shepard, of 134 West 73d Street, New York city, has invented a device



SAFETY ALARM DEVICE FOR MARINE VESSELS.

which will automatically sound an alarm when the water beneath the vessel is dangerously shallow, thus giving time to reverse the engines or change the course and prevent possible accident by grounding. At any suitable point in the vessel a cylinder is arranged which opens through the hull and is provided at the top with a cut-off valve. Within this cylinder is a second cylinder threaded into a cap which forms a cover for both of the cylinders. Extending through this cap is a small tube, to the lower end of which a thimble is connected by means of a link. This thimble incloses a spring, on the lower end of which a block is secured, which carries a contact finger projecting through a slot in the wall of the thimble. The block is connected by means of links and a swivel joint to a ball at the bottom of the cylinder. This ball has bearing in a socket or seat which while holding the ball in place yet allows it universal rotary movement. Depending from the ball is a rod formed of a close coil of bronze. This construction produces a fairly rigid rod, but one having sufficient spring to prevent breaking when coming in contact with an obstruction.

In operation the depending rod, on striking the ground or bed of the waterway, will be deflected, drawing down the spring block and bringing the contact finger into engagement with the contact piece on the cylinder wall. This completes the circuit of an electric bell and battery, as conventionally shown in our illustration, and the ringing of the bell warns the pilot of danger. The purpose of the cut-off valve on the outer cylinder is to prevent water from flowing into the vessel when the apparatus is removed for inspection or repair.

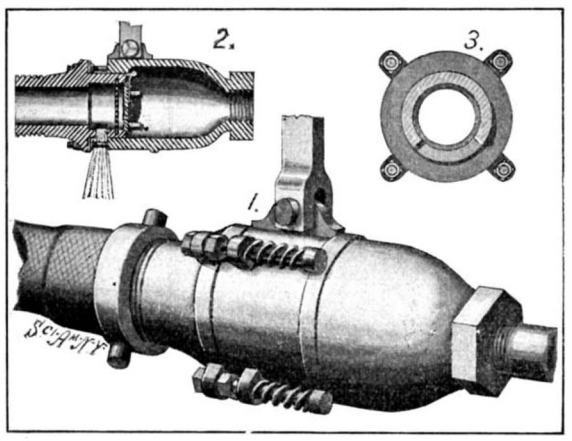
First Dynamo Described in a United States Patent.

The earliest United States patent on electric generators was issued on March 30, 1852, under the title "Electric Whaling Apparatus." The apparatus was the invention of Dr. Albert Sonnenburg and Philip Rechten, of Bremen, Germany. The invention provided a means for capturing whales "by the application of electric galvanic current conveyed by a conductor to the instrument commonly called 'whale iron,' or 'harpoon,' and which is used to be thrown into the fish." The current was produced by means of a "magneto-electric rotation-machine." The inventors describe their generator as a machine containing "four or more horizontal permanently-fixed boat-magnets placed opposite each other, which produce the electric current in four or any other convenient number of inductors. The inductors are attached to a rotation axle by a cross, a disk, arms, or other means well known in the construction of magneto-electric machinery, and get their rotation before the magnetic poles by means of a crank or other suitable gearing. Through a commutator on the axle, on which slides a strong, steel spring in the shape of a fork, the counteracting currents in the wires on the inductors are thrown into one and the same direction." The current was conducted to the harpoon head by a "gilt copper wire covered with India rubber, and thus completely isolated from salt water." On harpooning a whale the machine was operated, generating a current which flowed through the animal, the circuit being completed through the sea water to the copper bottom of the boat, and thence to the dynamo. As to the power of this machine, the inventors claimed that the whale received "about eight tremendous strokes at each turning of the machine handle. If only two turns be made each second, she receives 960 strokes each minute—so formidable a power that no living being can resist the same." In order to reassure the operator of so deadly a machine, the inventors state that "there is no possible personal danger in using our machine or apparatus, except the man who throws the whale iron take the metallic part of it into one hand and put the other hand at the same time into the sea when the machine is in motion. But such a position is not to be assumed, as it cannot take place except intentionally." The patent also contains some interesting advice in regard to the proper care of the machine. "If good care be taken of the apparatus, there is no wearing it out; only keep the wet out, and do not let it be thrown about or be roughly handled. Should the machine refuse its wonted effect, examine whether the inductors be too remote from their magnets. The distance between the inductors and their magnets should be such that a French playing card can be put between them. Examine whether the steel spring on the commutator be in such a condition that intensive sparks appear when the machine is in motion; if not, regulate it by the small screws connected with the same." It is interesting to compare this crude machine with our present-day generators, and note the rapid strides which have been made within the fifty years intervening.

IMPROVED FEED-WATER FILTER.

A recently-invented device which is applicable to feed water pipes of locomotives consists of a filter which not only prevents foreign matter from entering the boiler, but also embodies means whereby this accumulated matter may be ejected from the hose without requiring manipulation of the coupling. The filter comprises two sections; one which is stationary is secured to the feed-pipe and the other which is movable is coupled to the hose leading from the water tank. The latter section is formed with a reduced portion adapted to fit into the mouth of the main or stationary section, normally forming a water-tight connection therewith.

In order to hold the sections in closed position four bolts threaded into lugs on the movable section pass



EASILY-CLEANED FEED-WATER FILTER.

loosely through lugs on the stationary section, and are provided with springs which bear between the latter lugs and the heads of the bolts as shown in Fig. 1. The end of the movable section is provided with a gate opening outwardly so that it will be forced open by the flow of water into the feed pipe, but will close when pressure is exerted in the opposite direction. Immediately back of this gate is the filtering sieve, and directly back of the latter a segment is cut out of the reduced portion of the movable section as shown in Fig. 3, forming a port through which the foreign matter collected on the sieve may be discharged. Normally this port is closed by the overlapping mouth of the stationary section. But when it is desired to clean the filter steam is admitted into the feed pipe, causing the gate on the movable section to close as shown in Fig. 2. The steam then acts on the gate as a piston, forcing the movable section outward against the tension of the springs, thus opening the discharge port. A small opening is formed in the gate, and through this a small volume of steam passes, spreading through the sieve and blowing off the collected sediment, which thereupon flows out with the water through the discharge pipe. When the filter is sufficiently cleaned, the steam is cut off, and the parts return automatically to their normal positions. A patent for this invention has just been granted to Mr. James F. Barrett, 20 South Church Street, Carbondale, Pa.

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Berliner's Advice to Inventors.

How an inventor ought to invent is told by Emil Berliner, himself well known for his improved telephones and sound-recording devices, in a recent number of the Saturday Evening Post.

"I had for years been studying the science of electricity and the physics of sound when Mr. Bell's patent was issued in 1876," writes Mr. Berliner, "and it occurred to me at once that the knowledge I had absorbed in my studies might be very profitably applied to improve the telephone. At that time I was engaged in commercial pursuits in Washington, and my experiments and studies were more in the nature of a recreation than anything else. I paid frequent visits to the central office of the Fire Department, the electrical superintendent of which, Mr. Richardson, was a particular friend of mine. He had a dummy telegraph instrument on which he had taught me telegraphy, and on this particular evening I was working the instrument as usual, when he said:

"'You don't press hard enough, Berliner.'

"'Does that make any difference?'

"'Certainly; it makes all the difference in the world in the strength and clearness of the message at the other end. That is why women do not make good and effective operators as a rule. They are not strong enough—their touch is too light. They do not give thorough contact.'

"That was a revelation to me. Under Mr. Bell's invention the voice had to vibrate a diaphragm against a magnet, and the volume of electricity thus produced was not sufficient to transmit sound waves sufficiently strong. That night, before I went to sleep, I had set up the movable diaphragm used in the telephone today, which keeps in constant contact, but with varying pressure, with the transmitting end of the telephone wire, simply pressing back and forth as the sound waves produced by the voice diminish or strengthen.

"Another case illustrating this point occurred not so many years afterward. Upon the completion of my invention of the constant contact sound transmitter, the Bell telephone people engaged my services as expert to aid in perfecting the telephone, which was still in a crude state. Mr. Blake had just invented his form of transmitter and the instrument was placed in my hands for final development. It secured a very much clearer transmission than had been possible before, but one of its troubles was that the carbon button used would rapidly wear holes at the contact. The material was so soft that it kept us busy replacing or refacing the carbon buttons. These buttons were made from the ordinary long soft carbons used in arc lights, which had only just appeared in the market. They were made by sawing the long carbons into thin circular buttons. We conducted all sorts of experiments with a view to securing a hardening of this carbon, but for a long time we failed in effecting any improvement. It was well known that the hardest carbon in the world was that which is deposited in gas retorts. This carbon deposit had always proved a serious source of trouble since the manufacture of coal gas was invented, because it has to be cleaned out from time to time, and this is a difficult job.

"It occurred to me to have a little iron cage built, into which I put a lot of our soft carbon buttons. This cage I asked the gas people in Boston to put into their retort on the next occasion when they were ready for a charge. I left it there during six charges; then, when I took it out, I found my carbons all shriveled and shrunken. The intense heat had half burned them up. They were all rough, and for a little while I thought there was another failure. In a contemplative mood I began to rub one of the roughened buttons on a piece of emery paper to see what polishing might do for it. Soon I had rubbed away entirely the spongy rough surface and got down to the original button. Examining this closely, I found to my great surprise that the carbon itself was practically unchanged, except that it had become tremendously hardened. A closer inspection showed that not alone had the carbon in the gas deposited itself on the surface of the buttons, but that it had also penetrated the pores of my carbon, filling them up absolutely and making buttons as hard as any one could desire. That was in the year 1879. By exposing to fewer gas charges we thereafter produced a carbon button that was at once hard and smooth, and to this day this process is employed. Nothing has ever been found that hardens carbon buttons for telephone use better or more economically."

Dr. F. O. Hawley, the city physician of Charlotte, N. C., has recently received a patent on a fumigator, which he says is much simpler and more effective than anything else he has seen for the purpose. The city recently suffered from an outbreak of small-pox, and was compelled to buy a number of fumigators, and nearly all of them were unsatisfactory in some respects, and those which did the work properly were generally very expensive or cumbersome. The device which the doctor has made can be made and sold for about one-third the cost of the average implement of this character, and the doctor says that he has several times demonstrated that it can do more work than the best of them.

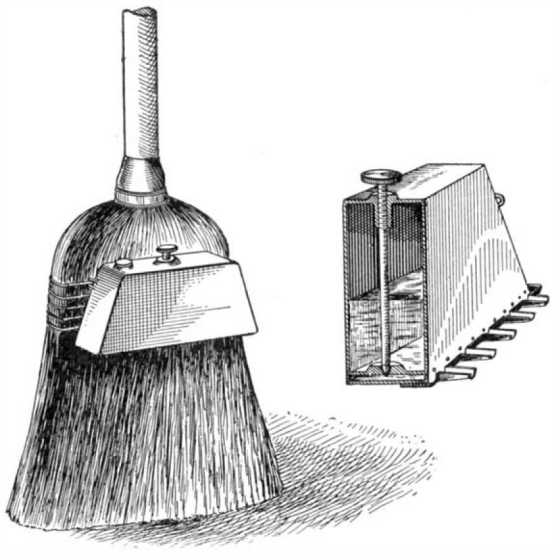
ODDITIES IN INVENTIONS.

EYE SHADE.—Eye shades now commonly in use are clumsy affairs, covering the whole forehead and held in place by spring strips which are adapted to fit tightly against the head. A recent patent provides an improvement on this device, which is illustrated herewith. The improved shade has approximately the form of a pair of spectacles, being held to the head by bows and loops arranged to loop over the

EYE SHADE.

ears, and a nose bridge to prevent the shade from falling down over the face. In place of the lenses small shades are provided, one for each eye. The shades consist of semi-cylindrical portions projecting forward to shield the eyes, and vertical portions adapted to fit closely to the line of the forehead, thus preventing entrance of light at that point. The shades are so arranged as not to interfere with the action of the eyelids.

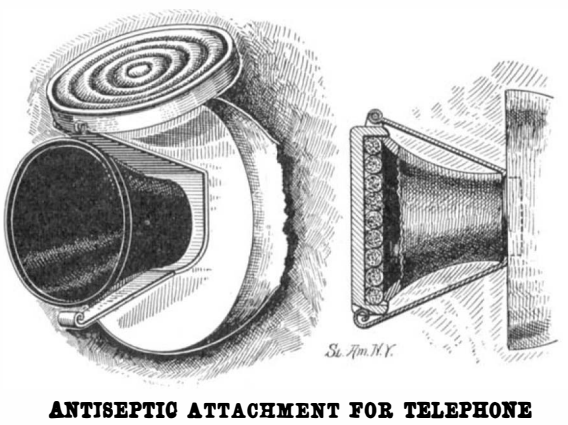
BROOM ATTACHMENT.—By the use of the broom attachment illustrated herewith, oil may be supplied to a broom in any desired amount for the purpose of oiling floors, etc. The attachment consists of a can provided with a false bottom forming an auxiliary chamber which communicates through a series of perforations with spouts projecting between the straws of the broom when the device is secured in place. The



BROOM ATTACHMENT.

oil or other liquid is stored in the can, and may be fed into the auxiliary chamber through a small opening, controlled by a needle valve, whence it passes through the spouts to the broom, and is distributed to the lower ends of the straws on the broom for application to the floor. The series of troughs are connected by a channel, so that in case an opening from which one of the troughs is fed should become clogged, the trough could receive its quota of oil from the common channel. This attachment will be found useful also for moistening the floor with water, to prevent raising the dust when sweeping.

ANTISEPTIC ATTACHMENT FOR TELEPHONE MOUTHPIECES.—The mouthpiece of a telephone, which is in constant use by a large number of persons, is apt to become charged with filthy and even contagious accumulations from the breath of the users. To remedy this evil two Californians have devised a simple little attachment designed to deodorize and disinfect the mouthpiece. A small bracket is employed, consisting of a plate with two outwardly-projecting arms. This plate is provided with a central opening adapted to fit over the threaded shank of the mouthpiece, and it is firmly held between a shoulder on the mouthpiece and the receiver proper. Hinged to the upper projecting arm of the bracket is a cap adapted to normally close over the mouthpiece. This cap is provided with any suitable absorbent material, saturated with a sterilizing or antiseptic substance, which will deodorize and disinfect the mouthpiece. The cap is held tightly against the mouthpiece by the lower projecting arm of the bracket, which serves as a spring catch therefor. In use the cap may be easily swung up clear of the mouthpiece, as shown in our illustration.



ANTISEPTIC ATTACHMENT FOR TELEPHONE MOUTHPIECES.

A Patent's Strange Career.

BY IRVING W. TOWNSEND, EXAMINER, U. S. PATENT OFFICE.

It is a strange and unprecedented occurrence that a patent should have been passed upon by seventeen judges, including the Supreme Court of the United States, and its validity be as open and undetermined a question as it was prior to the bringing of the first suit upon it. It is only by a combination of very unusual circumstances that such a condition of affairs could have arisen. Of these seventeen judges, eight have upheld the patent, eight have found it unpatentable, and one has been upon both sides of the question. Nothing could have been more evenly balanced.

In 1887 Levi Bywater obtained patent No. 374,888, claiming "a knitted fabric, composed of face and back yarns of different materials, the face yarn being looped at regular intervals and on alternate stitches of adjacent rows of the back yarn, and being matted and curly, and having a smooth back, whereby the said fabric has the appearance of looped or Astrakhan cloth, as described." When suit was brought upon this patent, the British patent to Booth of 1881 was set up as an anticipation. Prior to these patents imitation Astrakhan had been produced, but it was always a woven, not a knitted article. The whole question, which has proved so puzzling, is whether the British patent discloses imitation Astrakhan, or whether the change, if any, made by Bywater, involved more than the skill of the artisan. The British patentee claimed to have invented a novel description of looped fabric of ornamental appearance. Just what this means is uncertain. Apparently, he did not claim to knit Astrakhan. Knitters of the present day have, following the direction of the British patent, undoubtedly produced knitted imitation Astrakhan, but the question still remains whether they have not, in so doing, made something that Booth did not have in mind, for the law undoubtedly is that a foreign patent is not to be measured by its possibilities, but by what it substantially displays—what is necessarily inherent in it. Bywater in producing his fabric, uses Mohair yarn, which will both mat and curl, so as to give the shaggy appearance of Astrakhan. Booth used a backing of wool, capable of felting, and for the face a long-fibered yarn, incapable of felting, laid in position in loops. When the fabric was felted the loops projected. If a curly or krinkly yarn happened to be used, the loops curled, but the patent does not apparently suggest both matting and curling. Bywater seems to have made a wise choice of yarns, using those that necessarily curl, and by patient work in mechanical development, has provided his fabric. Has he, in so doing, exercised invention?

Judge Dallas, in Hanifen vs. Godshalk Co. (78 F. R. 811), sustained the Bywater patent, but upon a rehearing he changed his mind, and held the patent invalid. Upon appeal he was reversed, although by a divided court, Judges Shiras and Acheson holding the patent valid and Judge Butler dissenting (84 F. R. 649). This was in the Third Circuit. The patent was next sued upon in the Second Circuit and was sustained by Judge Townsend (Hanifen v. Price, 96 F. R. 435), but he in turn was reversed by the Court of Appeals for that circuit in an opinion rendered by Judge Shipman (102 F. R. 509) and concurred in by the two other judges. Hence, as the patent was invalid in New York and valid in Philadelphia, the United States Supreme Court allowed a writ of certiorari, and it was naturally expected that the matter would thus be put to rest. But it so happened that only eight justices sat when the case was heard and that the Court was equally divided. Such a decision is recognized as an affirmance of the decision appealed from, and as the writ of certiorari happened to have been allowed from the Second Circuit, where the patent was invalid, the decision of the Supreme Court was that the patent was invalid. Had the writ of certiorari been allowed from the Third Circuit, where the patent was valid, there would also have been an affirmance with the result that the patent would have been held valid. It seems clear

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that such an affirmation can establish no precedent, although there is little law upon this point.

As the United States Supreme Court had held the patent invalid, infringers naturally sprang up, resulting in a new suit in Philadelphia, where the Court of Appeals had held the patent valid. District Judge Archbald held that the decision of the Court of Appeals for that circuit was binding, thus apparently or nominally reversing the United States Supreme Court, but in view of the anomalous condition of affairs he considered the matter elaborately upon its merits and arrived at the independent conclusion that the patent is valid (Hanifen v. Armitage, 117 F. R. 845). Thus the seventeenth Judge has passed upon it. It will next, doubtless, be passed upon by the Court of Appeals for that circuit, and finally come again before the United States Supreme Court, where a full court will give the concluding decision, thus giving the matter quietus after twenty-nine judges have passed upon the patent.

A Few Problems for Inventors.

An Australian correspondent, Mr. Edwin Phillips, puts to us a few inquiries, which may well engage the attention of inventors.

Recently the Melbourne Herald published the following item: "A shunter employed on the Silverton tramway was engaged in shunting when his foot became jammed between the rail and the check rail. Before he could extricate himself the trucks were upon him, mutilating his body terribly. He was killed." Who will devise a cheap and easily-applied device for coupling or uncoupling railway trucks and carriages without the "shunters" or "couplers" having to risk lives and limbs by passing over rails, beneath buffers, and below vehicles?

A port health officer while stepping on board the customs launch at the Port Melbourne railway pier (says a Melbourne daily) to proceed to a French mail steamer, missed his footing and fell into the water between the launch and the pier. Several seconds elapsed before he reappeared. Though willing hands helped him out, yet what was to have prevented his being drowned? Why should not a come-and-go—a give-and-take—gangway be seen? Or some other better combination of elements?

Will wood choppers and timber cutters ever have provided for their use a light, portable, and easily-applied metallic boot shield or attachment? Says the Argus (Victoria): "W. Middleton almost severed his left foot at the instep yesterday when cutting timber at Dr. Butterworth's farm at Dumbalk. During the journey to Meenlyan he fainted several times through loss of blood, and twice he fell off the wagon through the roughness of the road. Each time the wheels passed over him."

"While returning from Traralgon, Mr. G. Dayble, of Morwell" (writes a correspondent of a Melbourne paper), "was thrown out of his gig and received a severe shaking. The horse bolted with the vehicle for about five miles, when it collided with the post of a bridge, smashing the gig to pieces." Which of these accidents was avertable? The first (the throwing out of the driver) or the second (the bolting of the horse)? Would some hand rail or guard have prevented the first, and a retaining brake the second?

The leaders of four horses of the Bruthen-Bairnsdale coach, while standing outside the post office waiting the mail, shied so vigorously that, the wheels locking, the coach was overturned. The seven inside passengers and one on the box were quickly removed from their dangerous position. What (1) should have prevented the wheels locking? What (2) the overturning of the coach?

Mr. T. Hodby, of Pimpinio, Victoria, was feeding a chaff cutter, when by some unexplained means his left fingers were caught by the cogwheels and drawn into the machine. His hand, after a ten-mile drive, was amputated at the wrist, and a combined fracture of the forearm set. Which was to blame? The machine or the man? Couldn't machines be made which preclude (1) the hands being drawn therein or (2) machines which could be instantly stopped?

What might have ended in the foundering of the ketch "Violet" and the loss of life occurred at Port Campbell. And the question arises what other safeguards, besides periodical inspection and testing, should be adopted in connection with all public cranes. For "when discharging an anchor weighing two tons, the crane pillar broke off and fell onto the deck. One of the seamen just managed to escape."

A ganger's awful death was recently chronicled in the Melbourne papers. It appeared that the unfortunate man was propelling a railway tricycle when the train leaving Eltham overtook him and cut him down. The deceased was approaching the age for retirement from the service, and leaves a large family. Would that family have been left fatherless had some mechanical device been attached to the tricycle in the form of a buffer or fender? Or any other arrangement whereby such terrible consequences could have been avoided?

"Mr. W. Tregise, of Waterloo, met with a severe accident. While driving home, the bit broke in the mouth of the leading horse. The animals then bolted. To reach the horse's head, Mr. Tregise jumped down, but his legs entangling with the reins, he fell, and was run over. In addition to a deep wound at the back of the knee, his left arm was broken." Fortunately, two passers-by stopped the bleeding. Which was at fault—(1) the bit, (2) the brake, (3) or was it a combination of these? And what is to prevent the recurrence of the same thing unless an emergency brake is introduced, or an emergency horse-releasing device?

In the past, accidents, because they have been accidents, have generally been regarded as unavoidable. But experience teaches differently. Experience shows that accidents may be divided into two classes: (1) preventable, (2) unpreventable. It also shows that a hard-and-fast line can be drawn between those that can be avoided and those that cannot be avoided. Likewise that the list of the preventable accidents is growing every year. In other words, that invention is rapidly increasing the ratio of the preventable accidents as compared with the unpreventable ones. By reform in thought, accidents which were formerly consigned to the second class are now elevated to the first. Who can still further benefit the human race by increasing the preventable accidents at the expense of the unpreventable ones?

Brief Notes Concerning Patents.

G. Foster Howell, the editor of the American Shipbuilder, has invented a form of ship's pump which is operated at a cost of merely the oil used in lubricating the parts. It consists of a normally horizontal lever with a vertical pump rod at each end and a weighted pendulum in the center. The roll of the ship swings the pendulum, and thus drives the pump rods.

According to the Birmingham, Ala., Age-Herald of November 17, Andrew Beard, a colored man of that city, invented a car coupler which he sold to the Janney Company, the amount mentioned being $100,000. Beard received a payment of five thousand dollars, and with this had some beautiful models of his invention made, and carried them to the office of the company. It is said that he will receive a royalty of fifty cents on every coupler made.

United States Consul W. W. Canada, at Veracruz, Mexico, writes under date of May 16 as follows: "A bill has been laid before the Congress of Mexico providing that trade-marks shall be registered and patents for inventions granted without previous investigations respecting their novelty or originality. Petitions for registrations of trade-marks and applications for patent rights are to receive prompt attention, and measures shall be taken to effect a reduction in the charges made for such service. A special code of penal laws for the prevention of fraudulent uses of trade-marks, etc., and violation of patent rights is to be prepared. The law to be enacted shall be in accordance with the convention of Paris, March 20, 1883, that there may be no impediment to Mexico joining the International Union for the Protection of Industrial Rights."

Up to a very short time ago the glass blower has been the autocrat of the trades, but at present he is, figuratively speaking, at sea. The blower's work has been one of the last to give way to mechanical advance. It is said that the individual earnings of good blowers averaged from $250 to $400 per month, and in many places the blowers of an establishment lived in a degree of luxury which compared to that of the employer. The forty factories in this country which are under one control, and which comprise the bulk of those in this country, were all closed simultaneously a few weeks ago, in order to permit the installation of a new machine which the concern has been experimenting with for some time. All the operatives were thus thrown out of work, and there was much speculation as to what the result would be when the factories are opened again. The machine is the invention of John H. Lubbers, of Pittsburg, Pa., who was once a glass blower, and it is said to be marvelous in its operation and the amount and character of its product. The details of the new mechanical installation have not been allowed to creep out, but it is inferred that the company making this advanced step is fully assured of the success and economies of the new machine glass blower.

Irving E. Burdick, a Yale man who achieved some considerable renown as an inventor by the designing of a very successful electric lamp for submarine purposes, while at college, has recently appeared with another invention of great importance. This one is a system of automatic train control. In order to demonstrate the reliability of his arrangement, he has constructed a very elaborate model, which has been on exhibition in New York, where it has been inspected by a great many of the most prominent railroad men in the country. In case of a broken rail, open switch, open draw, water covering the tracks, or the presence of a train in the same block, a signal is given in the cab, the steam supply of the engine is cut off and the brakes applied, and the train brought to a gradual stop, these operations being automatically effected. The usual visual signals along the line are rendered entirely unnecessary by this system, but they may be used in connection with this plant as auxiliary signals. The engineer has but to watch the lamps in his cab. There are two used in this connection, one of which is always glowing. One lamp indicates clear track, and the other indicates the presence of danger, and if the engineer fails to notice the danger signal or does not immediately act accordingly, the train is automatically brought to a standstill.

It is almost the invariable experience at conflagrations of any considerable proportions, that the water mains are drawn on to such an extent by the great number of hose connections, that the water pressure becomes considerably impaired. The result of this is that it is impossible to make use of the water which is available, for the reason that the flow is so feeble that it is out of the question to reach the flames. The standard nozzle in use is about an inch and a half in diameter, which is suited for the average pressure, but where the latter is decreased, it is also desirable to decrease the size of the nozzle. To exchange one nozzle for another under the circumstances is not convenient, and in order to meet the demands an adjustable fire hose nozzle has been invented and patented by Harry E. McKechney, a member of the fire department of Rochester, N. Y., which has the advantage that while the hosepipe is in use, the size of the discharge can be varied to a considerable extent. For instance, the size of a one and a half inch opening may be reduced to one five-eighths inch in diameter. The nozzle consists of two parts, a tip and a base, which are fitted together and held loosely by a worm. Inside the nozzle are a number of overlapping staves of thin metal, each one strengthened by a rib of stronger metal. When the full stream of water is to be had, the water pressure will force these staves back against the walls of the nozzle, and the stream will not be interfered with; but when the supply is limited, the size of the discharge is reduced by turning the tip, which by the action of the worm, draws the thimble-like tip down, and thus brings the stave-like sections closer together. This nozzle has been in use for some time in the Rochester department, and has been found to be of great value. It has been also called to the attention of the fire officials of Philadelphia, and a series of trials will be made of it in that city to determine its value. It is expected that these nozzles will be of the greatest service as part of the equipment of office buildings and the like, where the pressure is obtained from tanks.

A decidedly uncanny but most useful invention will be shown in the Liberal Arts Department at the World's Fair. It is a practical device for feeding and delivering paper to and from a platen job printing press. It is a ghostly-appearing device. Two long thin arms of hollow metal, each having five long, crooked fingers, apparently lifelike, ply silently to and fro, feeding the press and removing the printed sheets. By this invention it is possible for one person to operate six job presses at the same time, thus materially reducing the expenses of printing establishments. The inventor of this unique and useful device is Percy F. Rice, a twenty-year-old resident of Tustin, Cal. He began work on its invention eighteen months ago. While watching the movements of a job press in a Los Angeles printing office, one of the employes suggested that he try his inventive genius on a mechanical job-press feeder. Young Rice immediately retired to his workshop, and after nearly two years' hard labor attained success in his new invention. This mechanical feeding and delivering device is a small and comparatively inexpensive attachment for job presses. Its principal parts are the two hollow tubes, with the equipment of fingers so adjusted as to work with the same reaching and retracting movement as the human arm. The finger tips are hollow, and through the functions of a vacuum pump attached at the foot of the press, the paper adheres to the tips the moment they touch it, and is released as soon as the arm retracts and descends on the delivery platform. The whole device is geared directly from the press, and hardly any extra power is necessary to operate it. The arms are removable, and may be laid aside temporarily, so as not to interfere with the placing of the forms. The feeding arm raises a sheet from the pile and places it on the platen as the press opens. It immediately recedes, with a spirit-like motion, to secure another sheet while the press operates, and when the latter opens, the other hand is there, ready to remove the printed sheet and place it neatly on the delivery platform, where guideways are provided to keep the pile in order. This wonderful device is not the dream of a dreamer, but an actual mechanism that will be exhibited in the Liberal Arts Palace at the World's Fair.

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RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

GOLD-SEPARATOR.—M. C. WRIGHT, Sultan, Wash. The object in this case is to provide a separator which is simple and durable in construction, very effective when in use, and more especially designed for collecting the fine gold contained in the pulp of stamp-mills or in the material of placer-mining and for providing a ready discharge of the tailings in case they cannot be dumped into a running stream for carrying them off.

ORE-CONCENTRATOR.—E. W. KEELER, New York, N. Y. Among the advantages of this machine are, that a given quantity of ore is operated upon in different ways and thoroughly worked before final release; also, that the resulting products—waste sand, concentrated ore, amalgamated mercury, etc.—are arranged to be accessible and subsequently operated upon independently of each other. All parts being submerged in a tank of water, permits gold-carrying sands to be so treated that gold particles may fall on a silvered surface and avoiding friction and water on plates while forcibly pushed. Free mercury cannot become floured in its path, and every particle is preserved.

SEWAGE-EJECTOR.—J. W. COONEY, New York, N. Y. Mr. Cooney's invention has reference to improvements in devices for raising sewage or the like from a low level, such as the basement of a building, to a sewer-main on a higher level, an object being the provision of a device of this character that will be practically automatic in its operation.

DRYING-KILN.—LA F. C. VAN DUZER, Biloxi, Miss. Mr. Van Duzer's invention relates to drying-kilns adapted for use in drying different substances—such as lumber, bricks, and grain—although it is more especially adapted to the treatment of lumber, for the reason that this material can be economically and thoroughly seasoned in a comparatively short space of time. It is an improvement in that class of driers disclosed by a former letters patent issued to this inventor.

CALCINING APPARATUS.—A. LAWRENCE, Acme, Texas. In this instance the invention refers to improvements in apparatus for calcining lime or similar material, the object being to provide an apparatus for this purpose that shall be simple in construction and having a means for keeping the material in constant agitation when being operated upon.

AMALGAMATOR.—G. FLETCHER, C. E. DAVIS, and B. T. DOUGLASS, St. Clair, Nev. The invention relates to improvements in amalgamators; and one object the inventors have in view is the provision of a simple and cheap construction by which they are able to collect and retain the small particles of precious metals of the kind technically known as "flour-gold" and "flour-quicksilver" from the pulp, tailings, sand, or other material.

PROCESS OF MAKING ALUMINA AND BY-PRODUCTS.—L. R. KEOGH, Pembroke, Canada. The object of the invention is to provide a process for the manufacture of alumina and by-products, such as hydrochloric acid, sodium sulfate, sodium aluminate, sodium carbonate, and other substances that may be contained in clay, kaolin, bauxite, or other aluminous ores, sulfate of aluminum or other aluminous materials to be treated, and sodium chlorid.

Electrical Devices.

RHEOSTAT.—W. A. SHERLOCK, San Francisco, Cal. In the present patent the invention has reference to rheostats, Mr. Sherlock's more particular object being to produce a neat, compact, and efficient form of instrument capable of general use and especially suitable for cutting down the current of ordinary service-wires by merely tapping into the wires.

RECEIVER FOR WIRELESS TELEGRAPHS OR TELEPHONES.—A. PLECHER, Bristow, Va. A capillary electrometer in this invention is interposed in the circuit between the air-terminal and the earth connection, and the rise and fall of the electrometer's mercury column from the passage of Hertzian waves therethrough is made the means of announcing the call and of interpreting the message. One electrometer receives the call and another the message, a switch being so combined with both as to throw either into circuit between the air-terminal and the earth.

ELECTRICALLY-HEATED HANDLE.—R. A. FLIESS, East Orange, N. J. In this case the improvement relates to handles that are adapted to be used in the open air in cold weather, and has for its object the provision of a simple and efficient device for heating such handles. The invention is applicable, for instance, to the handles of the steering or speed-controlling levers of horseless carriages.

ANSWERING AND RECORDING TELEPHONE.—T. D. FREESE and C. J. FREESE, Elyria, Ohio. In this patent the invention has reference to telephony, and the more particular object of the inventors is the provision of automatic mechanism for answering calls in the absence of the operative in charge of the station and for automatically recording message received from the line.

ALTERNATING-CURRENT TELEPHONE.—A. PLECHER, Bristow, Va. The invention comprehends for the transmitter two local batteries, two induction coils, and two double microphones operated by one or more diaphragms, one microphone directing alternately-reversed impulses from the local batteries through the primary wires of the coils, and the other microphone directing the alternately-reversed impulses from the secondary wires of the coils over the line, each microphone being simultaneously operated by a vibrating part common to them both.

TROLLEY-CONTROLLER.—W. B. LEECRAFT, Denison, Texas. Broadly stated, the invention consists of peculiar means which operate to instantly pull down the trolley-pole when its trolley jumps the conductor wire. The invention utilizes air, gas, or fluid under pressure in connection with automatic means operating, when the trolley jumps from the wire, to pull down the pole and hold it down. It provides an automatic signal for notifying the motorman that the trolley is out of contact with the conductor-wire along the track.

Engineering Improvements.

WATER-TUBE BOILER.—J. F. HOTTMAN, JR., Dubuque, Iowa. The primary object in this case is to provide a fire-box in a water-tube boiler for locomotive service, and stationary or marine service, whereby the use of stay-bolts may be dispensed with in any part of the boiler, with great saving in expense which making and placing of bolts involve and avoiding danger to safety of the boiler from breaking of bolts, to which large numbers are subject in a locomotive-boiler in service a short time.

GOVERNOR.—R. HARRIS, Kansas City, Mo. The invention refers to governors used for various purposes—for instance, for controlling the amount of gasoline for explosive-engines. The object is to provide a governor composed of but few parts, not liable to get out of order, and arranged to work with the greatest precision and sensitiveness to accurately control the speed of the device on which it is used.

EXPLOSIVE-ENGINE.—R. HARRIS, Kansas City, Mo. In this patent the invention relates to multiple-cylinder engines; and its object is to provide an engine which is very effective in operation, avoiding sudden shocks and jars, arranged to utilize the motive agent, such as gasoline and air, to the fullest advantage, and to allow of varying the ignition period and varying the length of the stroke of the piston to obtain a variable compression and explosion period.

COOLING-JACKET.—W. R. HAMM, Simsbury, Conn. Briefly stated, the invention comprises a jacket proper combined with a number of radiating tubes, preferably arranged in two groups, one group extending longitudinally of and around the cylinder within the jacket and the other projecting through and outwardly from the jacket. It is especially applicable to automobile-engines, although it may be used in other connections with equally or nearly equally good results.

STEAM-BOILER.—W. DOBLER, Sumner, Wash. This invention has particular application to improvements in boilers of marine and stationary engines. The principal object is to provide an ordinary boiler with certain adjunctive features or attachments whereby the steam-generating capacity of the entire boiler apparatus will be greatly increased. The improvement is as applicable to a construction having a plurality of boilers as it is to a single boiler.

Hardware.

HINGE.—T. B. MCCREADY, Butler, Ohio. In this instance the invention refers particularly to spring-hinges for hanging screen-doors or the like, the object being to provide a hinge so constructed that the two leaves may be easily separated to remove the door, leaving one on the door and the other on the casing, which will have a better appearance than a casing when the hinge members are removed from the casing, leaving the screw-holes exposed.

BEVEL-SIDING HEAD.—E. C. PRICE, Eureka, Cal. This invention relates to improvements in bevel-siding heads or cutting attachments for machines for forming bevel-siding, beaded ceiling, flooring, battens, and certain moldings, an object being to provide a head of novel construction and so arranged as to be readily secured to the side spindle of the machine.

COMBINED DRILL AND REAMER.—J. E. FUHRER, Pittsburg, Pa. The object of the invention is to provide novel means for adjustably folding a drill and an improved countersinking reamer device in one chuck for successive use. The sleeve may be readily removed and convenient access afforded to the reamer-blades for their removal from the chuck-block. The blades may at any time be sharpened and replaced for renewed service.

LOCK.—O. KATZENBERGER, San Antonio, Texas. The invention relates to locks of the permutation type, such as covered by two former patents granted to this inventor. The details are such as to render the lock more convenient to operate, more difficult to surreptitiously open, enables the quick arrangement of parts on special combination, so as to change it at will, facilitates the locking of the lock when the details are changed from open adjustment, and enables the working of the lock mechanism to open it either by sense of touch or visual observation or both together.

BRACE.—J. HOLLEY, West Palmbeach, Fla. In the present case the invention has reference to a brace provided with a plurality of tools permanently attached thereto, said tools being mounted in a movable holder, so that any one of the tools may be moved into position for operation the same as a tool or bit applied to an ordinary brace.

LATCH.—W. W. DAVES, Cartersville, Ga. The latch is designed as an improvement on that class of devices wherein the bolt is projected by the action of gravity devices. Mr. Daves provides a construction which insures an easy motion to the bolt without the use of springs, allows the bolt to be retracted by turning the knob-spindle in either direction, and allows the use of thumb-plates in connection with a combined lever and weight in lieu of the knob-spindle.

BENCH-VISE.—F. J. WERMES, Cincinnati, O. The purpose of this invention is to construct a vise by which a grip more powerful than heretofore may be effected and also in which the jaws will move true against each other. This end is attained by providing two screws arranged in a certain peculiar manner and coacting with novel devices for simultaneously driving them, these screws thus drawing equally on the jaws and holding them true, the one with respect to the other.

Heating and Lighting.

GAS-RADIATOR.—T. E. MCNEILL, New York, N. Y. This structure has a large heating and radiating surface and provides for carrying off gaseous products of combustion. Burners are close to the floor to secure circulation of warm air. The radiator induces circulation of cold air from the room, and the air to be warmed is brought into contact with the radiator in a way to prevent overheating thereof. The air supplied to the burners is drawn from the room and discharged to secure ventilation. Hot combustion products go tortuously through the radiator and heat moderately a large area of radiating surface, and they may be throttled that their escape may be retarded and the latent heat be absorbed by the radiating surfaces.

ACETYLENE-GAS GENERATOR.—C. A. BUTLER, Port Townsend, Wash. In the present patent the invention has reference particularly to improvements in a carbid-feeding mechanism for acetylene-gas machines, an object of the inventor being the provision of simple means for automatically feeding the carbid in desired quantities, at suitable intervals, and in an efficient manner.

Household Utilities.

BED-SPRING.—J. L. BARNAMAN, Butte, Mont. This bed-spring improvement is adapted to be used in connection with the frame of a cot or bedstead; and the object is the provision of simple and efficient means for easily taking up any slack which may occur in the article through undue stretching of the bed-spring, thus overcoming sagging of the bed and contributing to the occupant's comfort.

ROLLING-PIN.—W. L. STANLEY, Cambridge, Ohio. In its general form the invention comprises a cylindrical body formed of sheet metal, with annular corrugations to strengthen the same. The body is provided with heads or ends, and a central shaft is run through the pin to carry the two handles, while the cylindrical body of the pin is further strengthened by an interiorly-located spiral rod lying against the inner wall of the body and extending throughout the length thereof.

IRONING-BOARD.—P. A. RASMUSSEN, Beresford, S. D. This is an ironing-board of that class designed to be removably engaged with a table-top or other suitable support, and the object of the improvement is to provide a board of simple construction that may be quickly attached to a table or other support and as readily detached and that may be adjusted to supports of different heights.

Machines and Mechanical Devices.

MACHINE FOR CONVERTING MOTION.—G. A. WALKER, Harrison, Oklahoma Ter. The invention relates to mechanism for converting rotary motion into reciprocatory motion. Though applicable to different uses in various arts, the improvements refer more especially to devices for imparting reciprocatory motion to the rods or dashes of churns and like structures. The principal object is to provide a mechanism simple in construction and organization of the parts or elements, and thoroughly effective in operation.

MACHINE FOR TURNING CROSS-HEAD PINS.—C. A. MATHENY, High Springs, Fla. Mr. Matheny's invention is in the nature of a novel construction of machine for turning the pins of cross-heads for steam and other engines. The cross-head pin which receives the pitman is ordinarily formed integral with the yoke portion of the cross-head and is connected to it between its jaws or branches at both its ends. This makes it difficult and inconvenient to turn the pins to a true cylinder. The invention accomplishes this work in a convenient, accurate, and practical way.

MACHINE FOR INSERTING DIAGONAL STRANDS IN WOVEN-CANE FABRICS.—L. JANSON, Brooklyn, N. Y. The purpose in this case is to construct a machine capable of being operated manually or by power, and, to provide a machine in which a rotary depressing device is mounted to travel over the cane fabric, depressing the warp-strands at each side of the weft-strands, and to so reciprocate a needle adapted to carry the diagonal strands that the needle will move concertedly with the depressing device, passing over the warp and under the adjacent weft-strands.

PASTEURIZER.—A. JENSEN, Topeka, Kan. This apparatus comprises a cream cylinder, having a cream-drainage connection at the bottom and a cream-overflow at the top and a flanged breast, an outer casing forming a steam-space, and removably connected to the breast, a removal cover for the cylinder having a journal-bearing and a revolving beater and scraper having a hollow axial shaft forming the inlet for the cream.

GOVERNOR FOR CENTRIFUGAL SEPARATORS.—H. F. HASSLER, Hecla, S. D. In this patent the invention refers to improvements in attachments for centrifugal cream-separators using the skimmed milk to accomplish the governing, an object being to provide a device by means of which the speed of the separator will be kept uniform, as it is well known that irregularities of speed cause fluctuations in the cream itself.

FEED-REGULATOR FOR ORE-FEEDERS.—C. Z. ELLIS, Berkeley, Cal. In the present case the invention has reference to improvements in machines for feeding ore to quartz-crushers or similar devices; and the inventor's object is the provision of an ore-feeder of simple construction and by means of which the ore can be evenly fed to the crusher or the like.

STEAMING APPARATUS FOR CLOTH.—F. I. BURGHER, Stapleton, N. Y. The object in view in this case is to provide an apparatus for steaming fabric during the shrinking and finishing process, the device being very efficient in operation, and arranged to prevent the formation of creases in the piece and to provide a perfect draining and carrying off of the water of condensation to prevent water from passing to the fabric and to allow only very dry steam to act on the fabric.

METHOD OF PREPARING FOOD PRODUCTS.—J. P. ROCHE, Louisville, Ky. Mr. Roche's invention relates to a method of eliminating water from distillery-slop and simultaneously producing a composite feed material which consists of vegetable material enriched by the food constituents of the liquid portion of the slop. The present invention is not restricted to the apparatus, because the process may be carried out by different forms of machine and in other ways than by machinery.

APPARATUS FOR PUNCHING MUSIC-SHEETS.—H. MEYER, New York, N. Y. In Mr. Meyer's patent the invention has reference to machines for perforating music-sheets for self-playing musical-instruments; and the object is to provide a new and improved apparatus for punching the sheets in a simple and exceedingly accurate manner according to the perforations in the pattern-sheet.

PUNCHING AND SHEARING MACHINE.—A. A. KOCH, Montezuma, Iowa. In this case the invention relates to improvements in punching and shearing machines, and the purpose is to provide a machine designed to be operated manually and in which changes for different-sized holes may be quickly made. Different sets of punch-dies and different sets of punch-carriers may be provided.

BEATING-ENGINE.—E. A. JONES, Pittsfield, Mass. The object of the present invention is to provide an engine arranged to insure a proper circulation of the pulp or stock in the vat and to cause the stock to readily flow to the discharge-pipe when emptying the vat without requiring manually-actuated rakes for pushing the stock to the discharge-pipe. The invention relates to beating-engines shown and described in a former patent granted to Mr. Jones.

PACKAGING APPARATUS.—A. L. HOLTON, Norfolk, Va. In this instance the invention is an improvement in packaging apparatus, being in the nature of an apparatus designed for use in dividing piles of note-sheets delivered from a rolling-machine into the desired number to form books; and comprises means for delivering sheets or the like in piles of a predetermined number and automatically delivering separate strips to divide the piles.

Of Interest to Farmers.

HORSE HAY-RAKE.—H. LINGELBACH, Merino, Col. The invention is an improvement in the class of so-called "push-rakes" or "sweep-rakes" by which hay is gathered by means of long teeth projecting forwardly from a rake-head, the team being hitched in rear of the latter and suitable means being provided for tilting the rake-head on the running wheels which support it.

FOLDING CRATE OR BOX.—W. H. CROSSLEY, Bloomsburg, Pa. One of the principal objects of the invention is the provision of an article which shall have the side members forming the frame thereof so jointed or connected by clips or hinges that the box may be quickly folded into its knock-down position, whereby boxes may be readily shipped from place to place in bulk with great economy and saving of space and at the same time the sides of the frame will be connected by hinges, so that it will be impossible for the same to become separated.

PLOW.—G. S. LATTA, Beria, N. C. The improvement is particularly in weight attachments for plow-beams, whereby weight may be added at the front end of the beam in order to depress such end of the beam. The invention

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is applicable to all beam plows and cultivators and can be readily applied and removed and adjusted as may be desired upon either iron or wooden beams.

CULTIVATOR.—G. W. HAMILTON, Council Bluffs, Iowa. Mr. Hamilton's invention refers to an improvement especially that kind adapted to simultaneously cultivate two or more rows. The purpose is to provide means under the convenient control of the driver whereby to impart either side or vertical adjustment to the cultivator-beams or both, all of the cultivator-beams being simultaneously moved to adjusted position.

HORSE-STALL.—G. B. EPPLEY, Washington, D. C. In this case the invention is an improved knock-down or adjustable and collapsible stall especially adapted for use in railway-cars for shipping stock, more particularly valuable horses, with safety and comfort. The panels allow ventilation without permitting the animals to interfere with one another.

HARVESTING-MACHINE.—J. H. BRAMMER, Hunters, Wash. The purpose of the invention is to provide means whereby to connect the cutter-bar, sickle, conveyor, and reel with the side of a vehicle and to employ an elevator in connection with the conveyor. The elevator enters a guarded opening in the vehicle-box at one side of a point centrally between the ends of the vehicle, the upper terminal being below the upper edge of the box, thus preventing loss of material by the wind or irregular driving as the material is delivered into the box.

Pertaining to Vehicles.

PNEUMATIC TIRE.—T. J. COOPER, Paterson, N. J. The inventor's purpose is to so construct a practically punctureless and non-collapsible tire and a wheel-rim of metal or wood or other material to which the tire can be quickly attached without danger of creeping, and to so construct the tire that it will not only be reliable and economic, but whereby two independent air chambers are provided supplied with air from one inlet-valve, and whereby the inlet-passages of both chambers are automatically sealed against leakage.

WAGON-TOP.—J. POHLIG, New Orleans, La. In this patent the invention has reference to improvements in wagon-tops, and particularly to the manner of hanging the side curtains, and the object in view is to provide simple means for guiding the curtains and keeping them straight while rolling up or unrolling.

WHEELED SCRAPER.—J. J. GLYDENBORG, Hillhouse, Miss. The inventor's object is to provide a scraper especially designed for use in building levees and other embankments, and in which the scoop will ride high, will be easily dumped, can be lifted out of the ground by the draft of the team, will be simple in construction, strong, durable, and easily repaired. It is an improvement in that class of scrapers represented in a former patent granted to Mr. Glydenborg.

Railways and Their Accessories.

TRACK DEVICE FOR INCLINED WAYS.—A. H. MCCLURE, Majestic, Col. The improvement is adapted for use in connection with inclined ways in mines and similar localities for the rapid transit of one or more loaded cars or vehicles. The object is to provide devices by which cars may be chocked at the upper end of a way and by which also they may be readily released and caused to descend the way with the use of little power on the operator's part.

LOCKING DEVICE FOR SEAT-GUARDS.—S. E. JACKMAN, New York, N. Y. The object in this invention is to provide a device for the seat-guard of a car, boat, or like vehicle arranged to securely hold the guard against accidental opening or opening by passengers of the vehicle while the latter is in motion to prevent passengers from leaving the seat during the ride, thereby insuring complete safety of the passengers.

SAFETY DEVICE FOR INCLINED RAILWAYS.—S. E. JACKMAN, New York, N. Y. This invention relates to apparatus for use in pleasure-resorts, etc., and is a division of the application for a former patent granted to Mr. Jackman. The object is to provide a device designed to prevent accidental return or downward movement of the car while traveling on the upwardly-inclined track portion of the continuous track in case of accident to the propelling mechanism, so that complete safety of the passengers is insured.

RAILWAY CAR.—J. M. HETFIELD, Plainfield, N. J. The object in view in this improvement is the provision of a car of the gondola or coal-carrying type with a cover or covers which will effectually prevent the entrance of snow, sleet, or rain, preventing the danger of freezing, and thus causing a saving of time in the unloading of a car. The car is equally adapted to carry lime, as the roof is absolutely water-tight.

Miscellaneous.

SEPARABLE BUTTON.—C. YEOMANS, New York, N. Y. In this case the purpose is to furnish a button capable of being firmly and expeditiously applied, and to so construct it that the more one section is forcibly drawn from the other the more firmly will both sections remain in locking engagement, and also to so construct the socket-section that a cap member will have limited play upon the body portion, it being necessary to move this member upon the body portion before the two button sections can be separated.

LETTER-OPENER.—H. C. ZENKE, New York, N. Y. The object of the invention is the provision of a letter-opener which is simple and durable in construction, very effective in operation, and arranged to enable the operator to quickly and accurately open a bunch of letters of various sizes and shapes at one operation without danger of injuring the contents of the envelope.

GLOVE.—C. WINKLER, New York, N. Y. In this instance the object is to provide a glove having the reinforcing portions or tips arranged to present a smooth surface to the wearer's fingers, to prevent uncomfortable contact of the wearer's fingers with projecting edges, seams, or doubled-up portions, at the same time avoiding undue thickening of the glove-fingers, but giving strength and a fine appearance.

ERASER.—H. B. TOOKER, New York, N. Y. The mechanical eraser in this case is more especially designed for use on type-writing machines and arranged to enable the operator to quickly and accurately erase either a single letter, sign, or the like, or a word or entire line without danger of marring the remaining writing or injuring the paper.

MEASURING DEVICE.—F. M. STEADMAN, Puebla, Mexico. The device is very compact, comprising simply a disk on which is mounted a roll of specially graduated tape. The size of an object at a known distance or the distance of an object of known size may be determined by noting on the tape at what distance from the eye the object will be eclipsed by the disk.

SIGHTING DEVICE FOR CAMERAS.—F. M. STEADMAN, Puebla, Mexico. In this patent the invention is in the nature of a sighting device for ascertaining exactly what confronting objects strike the image plane or for locating the image properly on the plane without looking on the ground glass to do so. The device is especially adapted to film-cameras with which it is impossible to use the ground glass, but is applicable to all cameras.

CAMERA ATTACHMENT.—W. E. MULHOLLAN, Juneau, Alaska Ter. Mr. Mulhollan's purpose is to provide a device which can be removably attached to any camera for the purpose of automatically operating the shutter at a predetermined time, enabling persons to take their own photographs from a point near to or at a distance from the camera.

INSTRUMENT FOR HOLDING ARTIFICIAL TEETH.—W. F. MCKIBBEN, Linneus, Mo. The purpose of the invention is to provide an instrument for holding teeth to be mounted, especially plate-teeth, so constructed as to firmly hold either end of a tooth while the other end is being operated upon and to duly accommodate the pins in the teeth whether the pins be arranged transversely or longitudinally of a tooth. Mr. McKibben has also invented another instrument for holding artificial teeth, the purpose of which is to furnish one adapted to hold what is known as "plain vulcanite teeth" for grinding purposes, the instrument so constructed that the position of the tooth may be reversed, enabling either side to be ground to the biting edge or adjacent thereto and wherein the teeth may be turned end for end and firmly held in any position.

PANORAMIC CAMERA.—C. MILLS, New York, N. Y. The object of the improvement is to provide a camera arranged to permit convenient adjustment of the film-carrier nearer to or farther from the lens, to allow the use of lenses of different focuses on the same apparatus, and to permit of presenting both concave and convex surfaces of the focusing-screen or film to the lens to distinctly bring out on the finished picture nearer or farther portions of the object to be photographed.

INSECTICIDE.—J. H. YELVINGTON and J. E. YELVINGTON, Nocatee, Fla. This solution has been employed with remarkably successful results, especially on orange-trees, pineapples, tomatoes, egg-plants, and other fruit-trees, vegetables, and cultivated plants. It acts not only as a most efficient insecticide and fungicide, but also invigorates and promotes the healthy growth and development of the trees and plants in a high degree.

HOLDER FOR MARKING OR ERASIVE MATERIAL.—R. P. HAFNER, Passaic, N. J. The inventor provides a holder in which a receiver is arranged to travel in direction of one or the other of the open ends of a tubular casing, which receiver is adapted to hold a stick of chalk or crayon at each end, or an erasive or marking material at one end and an erasive material at the opposite end, whereby the material attached at either end of the receiver may be exposed for use, or all the material may be concealed within the casing.

DESIGN FOR AN EASEL.—SABELLA G. DOHERTY, New York, N. Y. In this case the invention is of a new, original, and ornamental design for an easel. The easel is crowned with a wreath. The uprights of the back have holes for the purpose of adjustment of the picture rest to various heights. The base is highly ornamented and is placed on symmetrically curved feet, the whole effect being very agreeable.

WAIST-BELT ATTACHMENT. — A. T. GOLDFIELD, New York, N. Y. The main purpose of this invention is to bring the plates in close-hinged connection solely by the lacing of the belt through the plates, the plates having no direct hinge connection one to the other, and to so hinge the plates one to the other through the medium of the belt upon which they are supported that the plates will not move from the position in which they were placed.

STAIR-ROD AND SECURER.—S. A. BROWN, New York, N. Y. The principal object of the invention is to overcome many disadvantages and objections common to stair-rod and securer devices hitherto devised. Though applicable to wooden stairs, the improvements are especially intended for use in connection with stairs constructed of hard materials—such as marble or iron, for instance—and into which it is impossible to drive or insert tacks or the like for securing the carpet or covering in place upon the stairs.

FISHING-REEL.—O. ALLEN, Lincoln, Ill. What is called "backlashing" in the reel occurs by the overrunning of the spool, and thus the cast or flight of the bait is suddenly arrested, and often, when this occurs, the bait is separated from the hook and is lost. The line must then be drawn off the spool, and is often so tangled as to require considerable time to straighten out. This invention avoids these results and delivers the line from the spool without overrunning or the necessity of applying the brake.

BUILDING CONSTRUCTION.—A. MENCZARSKI, New York, N. Y. In this case the invention has reference to a fireproof building construction; and the improvement comprises a peculiarly-constructed span of material laid plastic between the horizontal metal I-beams running side by side and the structure thus constituted being allowed to set and form the floors and ceilings.

FASTENER.—E. S. GARDNER, San Angelo, Texas, care of D. T. AVERETTE. This fastener is designed for securing the eyes to traces or tugs or fastening stirrup-leathers together, the fastener being also applicable for various other purposes, the arrangement being such that the fastener securely locks the parts together and can be conveniently opened when desired to lengthen or shorten the traces, stirrup-leathers, or the like.

CIGAR-PERFORATOR.—W. K. HOLMES, New York, N. Y. The purpose in this case is to provide a device which may be worn upon a watch-chain, and so constructed that it will perforate a cigar inserted therein simultaneously from opposite sides, effecting clean, clear perforations whether the cigar be green or dry, and which will not crack or break the wrapper if the cigar be dry.

FLY-CATCHER.—J. SCHNELL, Macon, Ga. The invention is an improvement in that class of fly-catchers in which a surface of some form is smeared or covered with a sticky substance, which may also be attractive and deadly to flies and other insects. A candle or other light-producer may be adjusted at any required distance to attract insects at night.

BABY-COMFORTER.—H. SPENCER, New York, N. Y. In this instance the invention refers to improvements in devices for comforting or quieting young babies, an object being to provide a device for this purpose that shall be simple in construction and that when placed in a child's mouth will not only serve to solace the child, but will afford slight nourishment.

KNIFE ATTACHMENT.—G. E. CROSLEY, Albion, Wis. The improvement relates to an attachment for pocket-knives or for other devices having blades by which pencils may be conveniently and effectually sharpened. The edge of the knife-blade may be exposed to facilitate the cutting of finger nails, and also a roughened or filing surface is provided adapted to be used for filing and rubbing the finger-nails.

STARTING-GATE.—F. A. VIANEST, New York, N. Y. In this contrivance the invention has reference to improvements in starting-gates for use on race-tracks, and the object of the inventor is the provision of a starting-gate arranged at opposite sides of the race-course, of very simple construction and having a direct and quick perpendicular movement.

VALVE.—A. C. FAMBROUGH, Sonora, Texas. Mr. Fambrough's invention is an improvement in valves, and especially in valves designed for use in tanks. The construction is simple, easily applied to a tank, and the arrangement of valves such as will work in shallow water and permit a much greater flow, because the valve can be adjusted to a wide open position.

PLUMB-LEVEL.—W. B. BRADSHAW, Ennis, Texas. This device consists of a body portion having on its upper side front and rear sights, and also a compass, a depressed open-top casing having an outer arc-shape graduated flange, a box-shaped member having pivoted support within the casing and a glass front side, a suspended bob and lower fixed point within the box or pivoted member.

COUPLING DEVICE FOR SCREW-DRILLS.—C. CHRISTIANSEN, Gelsenkirchen, Germany. The invention provides a coupling device by means of which screw-borers of any desired length may be composed of shorter sections. Borers constructed in this manner allow of drill-holes to be bored of any depth in a narrow shaft and transversely to its longitudinal axis. If a borer of a certain length has been driven in up to its rear end up to the mouth of the drill-hole, an extension-piece, and so on, is attached to it by means of this device. When it is desired to sharpen the borer bit carry the lower part of the serpentine borer provided with the bit to the shop.

PLACKET-FASTENER.—A. D. BELL, New York, N. Y. In carrying out the invention Mr. Bell particularly contemplates the production of a clasp which may be secured to the placket of the skirt in such manner that when the placket is closed the fastener will be invisible, so that the skirt will present a neat and tidy appearance, thereby effecting a departure from the bulky, untidy seam and protruding fasteners ordinarily incident to the clasps commonly in use.

DESIGN FOR A GLOVE.—F. SCHMIDT, New York, N. Y. In this ornamental design for a glove, three separated bars or rows of heavy black twisted silk each bordered by a thin edge of white silk stitching extend from the knuckles to a line with the base of the thumb. A neat V shaped formation of the same material and execution as the bars complete the design.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 4887.—For makers of up-to-date turbine water wheels.

AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 4888.—For manufacturers of gasoline pressure lamps, hollow wire systems for lights, etc.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 4889.—For manufacturers of rope and cordage machinery.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 4890.—For makers of rubber stamp outfits, complete.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4891.—For makers of novelties suitable for the mail order business.

WANTED.—A partner with capital to introduce a new article to the bottle trade. Partner, Box 773, N. Y.

Inquiry No. 4892.—For the present address of the New York Crude Oil Engine Mfg. Co.

American inventions negotiated in Europe, Felix Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 4893.—For makers of machinery for manufacturing small wire corkscrews, such as used on patent medicine bottles.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4894.—For manufacturers of slot machines.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway New York. Free on application

Inquiry No. 4895.—For makers of gasoline motors for farm work.

We manufacture anything in metal. Patented articles, metal stamping, dies, screw mach. work, etc., Metal Novelty Works, 43 Canal Street, Chicago.

Inquiry No. 4896.—For makers of acetylene outfits for store lighting purposes.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4897.—For a small plant for bookbinding business.

Empire Brass Works, 106 E. 129th Street, New York. N. Y., have exceptional facilities for manufacuring any article requiring machine shop and plating room.

Inquiry No. 4898.—For makers of machinery for manufacturing match boxes.

An engineer in London is open to represent first-class engineering firm having good specialties. Send particulars to L. Fraser, 5 Butler Road, Harrow, England.

Inquiry No. 4899.—For an apparatus for experimenting in physics.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4900.—For manufacturers of enamel sheet iron.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4901.—For makers of small iron gearing about two inches thick, in large quantities.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4902.—For cotton mills using round looms for hollow shoestrings, etc.

Representatives for Spain.—Hormaechea, Elorriaga & Co., Calle Libertad No. 1. Po. 1o., Bilbao, Spain. Offer their services to represent American manufacturers of novelties and new patented inventions. Will handle agencies to entire satisfaction, guaranteeing best service. A 1 references furnished to parties interested.

Inquiry No. 4903.—For machines for grinding barber's clippers.

MANUFACTURERS! Want any parts made of any metal? Write us. Metal Stamping Company, Niagara Falls, N. Y.

Inquiry No. 4904.—For machines for concaving razors.

Inquiry No. 4905.—For machines for grinding shears and polishing them.

Inquiry No. 4906.—For manufacturers of electrical signs.

Inquiry No. 4907.—For manufacturers of steam rollers for a golf course.

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Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9242) B. Jonas says: You would oblige me much by answering the following question: I have a galvanic battery giving 15 volts 70 amperes. Is it practically possible to charge with it a 110-volt storage battery? A. A storage cell requires two and a half volts in the charging current and 4 to 6½ amperes per square foot of surface of positive plate, reckoning both sides. The 15 volts which you have in your battery will therefore charge six cells at once. You can divide the storage battery into parts, and charge them successively. It will be a slow job, as there will be nine sections to be charged. It would be far more economical in both time and money to have a connection to a heavy current in your city, and charge the battery in two sections at the same time.

(9243) F. B. P. says: Will you kindly tell me how much water will be discharged per hour through a pipe ⅛ mile long

6 inches dia., fall 1½ inches to 100 feet
9 inches dia., fall 1½ inches to 100 feet
12 inches dia., fall 1½ inches to 100 feet
24 inches dia., fall 1½ inches to 100 feet

through square box 12 x 12 inches, same length and fall. Don't want any laborious calculation, but an approximate estimate. Water at mouth of pipe covers the mouth 2 or 3 inches. Pipe at outlet to have free, unobstructed discharge. It is said that a pipe running full will not discharge so much as one not quite full. If that is so, I take it that a small obstruction at mouth (where mouth is fully covered by water) would regulate the flow, so that the pipe would not run quite full. Or would the unobstructed outlet in that length of pipe (⅛ mile) operate so as to prevent the pipe running full? Can you refer me to some work on farm drainage, modern drainage by tiling, etc.? Can you refer me to back numbers of SCIENTIFIC AMERICAN containing articles on that subject? If so, I will write for them. Can you refer me to work on farm buildings? A. Referring to your inquiry regarding the flow of water through a pipe ⅛ of a mile long, with a fall of 1½ inches to each 100 feet, we would say that a 6-inch pipe will deliver approximately 5,900 gallons per hour. A 9-inch pipe will deliver approximately 15,700 gallons per hour. A 12-inch round pipe will deliver approximately 34,500 gallons per hour. A 12-inch square box will deliver approximately 43,200 gallons per hour. A 24-inch round pipe will deliver approximately 207,500 gallons per hour. Each one of these pipes will deliver the maximum amount when running full. With a given fall, and a given quantity of water flowing, the velocity of flow will be greater if the pipe is large enough, so that it does not flow full, than it will be if a pipe is used so small that the pipe must flow full; but for any given sized pipe the maximum flow will occur when the pipe is full. It is immaterial whether you regulate the flow of water at the entrance or at the outlet, provided both are under water. We would refer you to, and can supply you with, the following books: "Irrigation of Farm, Garden, and Orchard," by H. Stewart, price $1.50; "Drainage of Farms," by French, price $1.50; "Drainage for Profit and Drainage for Health," by G. E. Waring, price $1.50; also "Barn Plans and Outbuildings," price $1.50, and "Stables and Outbuildings," price $2.50.

(9244) G. W. D. says: In your paper of September 19, 1903, Query 9174, F. M. L. asks for information in regard to the "Big Dipper." He states that "at present" (I suppose about September 1) the handle of the "Dipper" points toward the earth in the early evening, which is incorrect unless he was 10,000 miles to the eastward of the United States. At that date (September 1) the "handle" pointed upward about 45 degrees west between 8 and 9 o'clock, and therefore would point toward the earth in 9 hours, or between 5 and 6 o'clock in the morning. However, this is not the object of this communication. Is your answer correct? If so, what I know about astronomy goes for nothing. There is an annual revolution only about the north star. If there was a diurnal revolution from east to west, while the earth's diurnal motion is from west to east, there would be two apparent revolutions of "Dipper." A. There are certainly two motions common to all the stars in the sky—one a motion of rising and setting in the same manner as the sun, due to the rotation of the earth on its axis; the other a motion over from east to west, or if facing the north pole, over from right to left. This is caused by the revolution of the earth around the sun, and is accomplished in a year. Because of this motion, a star sets about four minutes earlier each night than it did the night before. The constellations in the north, which never set, have this motion, and can be seen to occupy all positions around the north pole in a year. The Great Dipper is below the pole at one time, and six months later, at the same hour of the night, is directly above the pole, 180 deg. from its former position. We do not think our answer on this point is wrong.

(9245) M. P. C. says: Please answer the following question: I have a double-acting steam engine, the cylinder of which is 1½ inches x 3 inches, speed 290 revolutions per minute. I wish to make a double-acting steam pump, to be connected directly to the engine piston rod. What should be the diameter of each inlet valve and each outlet valve? What should be the dimensions of the cylinder? What should be the size of the suction pipe and the discharge pipe? What should be the dimensions of the air chamber? What form of valve would be most suitable and simple? A. In reply to your question about a double-acting steam pump which could be connected directly with your engine, making 290 revolutions per minute, with a stroke of three inches, we would say that this speed is too high for any direct-connected pump to work satisfactorily. We doubt if the valves would open and shut smoothly in the length of time that would be available under the conditions you mention.

(9246) A. L. asks: 1. Why is an electric current generated when the two wires are connected together of the Edison-Lalande battery? A. The current flows when the two wires from a cell are connected, because the chemical action is ready to begin at the instant of closing the wires. Most cells have no chemical action in them till the wires are connected; then the chemical action starts, and the current is generated. 2. How can copper be reduced to copper oxide or black oxide of copper? A. Copper is reduced to the oxide by passing oxygen over and through red-hot copper. It is far better to buy the copper oxide if you desire to use it in a cell. 3. If the same chemicals are put in at first in a storage cell, will the cell generate electricity the same as a primary cell? A. If a storage cell is made with the proper materials all ready for action, an electric current will flow from it as soon as it is set up. They are not usually made in this way, but charged for use after they are set up. 4. How much water will a volt-ampere decompose? A. Water cannot be decomposed by a current whose pressure is 1 volt. At least 1.48 volts are required to overcome the counter E.M.F. of the hydrogen and the oxygen and produce any decomposition. The electrochemical equivalent of hydrogen is 0.00001038 gramme, and of oxygen, 0.00008283 gramme. One ampere will therefore decompose the sum of these numbers in one second, or 0.00009321 gramme. This is reduced to ounces by dividing by 28.35.

(9247) W. & Co. say: We are about to build a house for our own residence. It is to be built altogether of concrete, from the cellar floor to the peak of the roof. We have a 6-horsepower (rated) gasoline engine, by means of which we desire to light the building with 50 16-candlepower electric lights through the medium of a storage battery that will carry enough to run all 50 lights for six hours, or a smaller number for a proportionately longer time. We know practically nothing of electrical science save what is picked up in our ordinary contact with it; but we desire to do this job ourselves, partly as a means of self-education on the subject, even if in the end it should cost more than would the employing of an expert to do the job, and then we know nothing about the practical working of it after it is installed. What we want to know is as follows: How and with what kind of wire should the building be wired? Would it be safe to bury permanently the wires in the concrete without pipes? Is concrete an insulator, or would it be necessary to use heavily-insulated wire? What kind or make of dynamo and what kind and amount of battery would you advise? The dynamo will have to be connected to the engine by belt, as when not in use generating electricity, we desire to use the engine for running an air compressor for refrigerating purposes, a pump for pumping water to tanks in the attic, and a lathe and other tools in the shop in the cellar. If necessary we can send you blue prints of the house plans, showing the location of all lights, and engine, as well as the desired location of the electrical machinery and keys or switchboards. If there is any book you advise as covering these specific points, kindly let us know the title and price; but we would prefer that you would give us the information we desire as covering this particular case. A. There are many insulated wires suitable for wiring a house. You can safely buy the wire which any reputable dealer in your city may have in stock or may recommend. The installation of the wires, lamps, switches, cut-outs, fuses, etc., should conform to the rules of the Board of Fire Underwriters; there are usually State laws also. If you do not insure, you may of course put the work in, in any way you please. We are of the opinion that it would be safer and in every way better to employ an intelligent electrical man to plan and put up the plant and teach you all about it. Every man to his own trade is a safe rule. We would not advise the burying of bare wires in concrete. Insulated wires should be used. The underwriters here require the wire to be placed in iron pipes also. You can get a copy of the rules of the underwriters on application to the New York Board of Fire Underwriters, 32 Nassau Street, New York city. The conduits for the wire should be left in the concrete, so that the wires may at any time be accessible. As to the dynamo, we would say get any dynamo which is easily accessible in your city, so that repairs and replacement of parts can be made easily. If you get a machine made at a distance, it may have to lie idle for weeks while you wait for some part to be forwarded to replace a broken or burned-out part. The Westinghouse Electrical Company, Pittsburg, Pa., are near you, and make perfectly reliable apparatus, for every part of your installation, excepting storage batteries. They will probably advise you just what to get from beginning to end. You will then have a homogeneous installation. The chloride accumulator is very largely used for house lighting and central station work. You will not go amiss by selecting it. The amount of battery you will require depends on the voltage of the lamp, half as many cells as the voltage. You will require 150 ampere-hour cells if you only wish to run 50 lights of 16 candle power for six hours on one charge.

(9248) T. C. says: A house is supplied with water from a spring situated 68 feet below the water tank in the attic of the house, and about 200 feet distant in a horizontal direction. The water is raised by a hydraulic ram, and the pipe supplying the tank passes into the *bottom* of the latter. Would it be a good plan to pass a lightning rod through the roof of the house and into the water in the tank, instead of "grounding" the rod outside in damp earth? The water tank is of wood lined with tinned copper. The water pipes are of galvanized iron. A. We would not advise passing a lightning rod through the roof of your house and into the water in your tank, instead of grounding the rods outside the house in damp earth in the regular way. Water is not a good conductor, and we do not consider it good practice to have any part of a lightning rod pass inside of a dwelling.

(9249) S. H. S. says: I have a chimney on my house that causes lots of trouble during extreme cold weather in winter by "sweating" and leaking down into kitchen. The chimney rests on a support in kitchen, runs up through the attic, and extends about 4 feet above roof—total length, 11 feet. The house is built of brick, and the wall forms one side of chimney below roof. The chimney is larger than the ordinary chimneys, with a larger flue. What can I do to remedy this trouble? Must have the chimney rebuilt this summer, notwithstanding it was rebuilt last fall, but it crumbled badly last winter, on account of so much sweating and freezing. Would like to keep chimney same size as now to match others. How would it do to build a double chimney, leaving a small air space between inner and outer walls? There are no masons here that seem to know how to overcome the trouble. The chimney worked all right until it was rebuilt last fall. A. In reply to question concerning your chimney, we would say that it is impossible for us to definitely decide, without thoroughly inspecting the chimney, what is the cause of your trouble and what should be the remedy, but we are inclined to believe that a small air space between the inner and outer walls of the chimney would remedy the difficulty. It would probably be well for you to have this air space arranged so that you could allow a free circulation of air through it or not, as you wished, according to the weather conditions. This could be arranged by means of a small slide or damper.

(9250) P. J. V. V. says: Would you be so kind as to give me information about the way shovels and pickaxes are made in this country, and the machines they use for it? Could you recommend me a book or treatise which gives full explanation on the subject? A. Shovels and pickaxes are made in this country in a great many different ways, different manufacturers using different processes. Shovels are usually stamped from sheet steel, either by hydraulic pressure, steam hammers or drop forges, and pickaxes are usually drop-forged from wrought iron or mild steel. Tooled steel points 3 or 4 inches long are then welded to the picks with a forked or double scarf weld. We know of no treatise on the subject which would give you any detailed information.

(9251) C. W. N. says: Please answer through your query columns as to the meaning in recent advertisements of "brake horse power," mostly applied to motor bicycles and automobiles. A. The meaning of "brake horse power" as applied to motor cycles and automobiles is "power which the engine is able to develop and apply to the driving axle of the machine." The term is used to distinguish the power applied to the axle, or the effective horse power of the engine, from the power developed inside the cylinder. The difference between the two is the friction of the engine.

(9252) H. L. E. says: Will you please let me know where I could obtain an enlarged engraving of the American beam engine, such as appears on a marine engineer's certificate or license? It is as good an engraving of this kind of engine as I have ever seen (but it is a little too small). It also shows the engineer starting the engine. Do you suppose you could obtain one of the blank certificates for me, as I do not want them for any dishonest purpose, only, as I said before, I like the engraving very much, as it shows all the parts of the engine very clearly. A. We know of no engraving like the one on the marine engineers' certificates, and we do not think it will be possible for you to obtain one of these certificate blanks without passing the necessary examinations.

(9253) A. D. W. says: I am informed that there is an alloy on the market for machinery bearings similar to babbitt metal, but possessing the advantage of requiring no oil or lubrication of any kind; my informant, however, did not know the name of this alloy. It occurred to me that you would probably know if there is such a material to be had. I want it for very high speed but light work. A. In reply to your inquiry, we would say that there are a number of so-called antifriction bearing materials on the market, but we know of nothing superior to genuine babbitt metal properly lubricated with oil. In order to reduce friction to the minimum, oil or lubrication of a similar character is necessary.

(9254) J. R. P. says: Girder is 15 inches high and 50 feet long, resting on three piers or columns. Will there be any difference in weight upon the center pier or column, whether cut in the center directly over the center column, or if the girder remains in a whole piece? A. We would say that if the girder is uniformly loaded, and if the piers are absolutely level, the maximum stress in the girder will be less than if two girders of one-half the length were used, by a small amount. The formulas for calculating the stress for such "continuous girders" are very complicated, and the results are inaccurate if there is even a slight settling of any of the piers. For this reason such "continuous girders" are usually not considered good practice in bridge construction; and in building construction are usually figured on the same basis as simple girders extending over but a single span.

(9255) B. M. M. says: Will you please give me the difference in the number of heat units contained in equal weights of the best coke and hard coal? Also, what is the difference in the relative value of 24-hour, 48-hour and 72-hour coke? What would cause coke to clinker and run on the grates, and what is considered the best kind of coke for furnaces and stoves, when used as a substitute for hard coal? A. We would say that there is practically no difference in the number of heat units contained in equal weights of the best coke and the best hard coal. They are both very nearly pure carbon, and each contains about 14,500 British thermal units per pound. We know of no definite data regarding the comparative value of 24-hour, 48-hour, and 72-hour coke. We believe, however, that the difference in heating value is very slight indeed, and that the amount of this difference will vary with the kind of coal from which the coke is made. Impurities, such as silicates and certain iron compounds, in sufficient quantities, would cause the coke to clinker if the fire were hot enough to fuse them. Connellsville coke is one of the best cokes on the market, but the ordinary gas coke will burn satisfactorily; in fact, any coke makes an excellent substitute for coal when the drafts are properly arranged.

NEW BOOKS, ETC.

LA TELEGRAPHIE SANS FIL. L'ŒUVRE DE MARCONI. Traduit du Scientific American de New York. Par Emile Guarini. Brussels. 1903. Pp. 64.

Mr. Guarini's work is a translation of his review of the state of wireless telegraphy published in the columns of the SCIENTIFIC AMERICAN SUPPLEMENT. Mr. Guarini has not only traced the development of wireless telegraphy from the experiments of Hertz to the present time, but he has also shown what Mr. Marconi has accomplished, and what the prospects are of a syntonized transatlantic wireless telegraphic service. The work is to be commended for its conciseness and for its accuracy.

REMINISCENCES OF AN ASTRONOMER. By Simon Newcomb, author of "Astronomy for Everybody," "Popular Astronomy," etc. Boston: Houghton, Mifflin & Co. 1903. With photogravure portrait. 8vo. Price $2.50.

Prof. Newcomb's Reminiscences are certainly a most refreshing combination of scientific autobiography and astronomical anecdote. Prof. Newcomb has known almost every scientist who is worth knowing; and his meetings with the distinguished men of the world have usually been marked by the happening of some striking incident which makes their narration a matter of peculiar interest. Astronomers will read with particular interest that portion

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of the "Reminiscences" which deals with the transits of Venus in 1874 and in 1882, and of the founding of the Lick Observatory.

TASCHENBUCH FÜR FLUGTECHNIKER UND LUFTSCHIFFER. Von Major Hermann W. L. Moedebeck. Berlin: Verlag von W. H. Kühl. 1904. 145 Textabbildungen und 1 Tafel. Pp. viii, 587.

Major Moedebeck is well known among airship enthusiasts as the editor of an excellent periodical devoted to the interest of aerial navigation, and as an authority in aerial mechanics. In this second edition of his admirable textbook, Major Moedebeck has associated with himself three or four well-known experimenters. The book is intended as an advisory reference work for aeronauts. It is technical in its treatment of the various subjects discussed, thoroughly scientific, and from what we have been able to gather, fully trustworthy.

SUBJECT LIST OF WORKS ON THE MINERAL INDUSTRIES AND ALLIED SCIENCES IN THE LIBRARY OF THE PATENT OFFICE. London: Published at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W. C. 1903. Pp. 302.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending December 8, 1903,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid, purpurin-alpha-sulfonic, K. Thun.... 746,405
Adder and subtractor, pocket, T. M. Minor 746,352
Advertising device, E. Altman.... 746,232
Agricultural implement, F. W. Miller.... 746,547
Air brake system, H. R. Kuhn.... 746,107
Anatomical guard, boot, or pad, W. W. Keen.... 746,338
Andiron, fireplace, A. A. Low.... 746,539
Anesthetic administering apparatus Richardson & Field.... 746,380
Animal cover, J. Murphy.... 746,359
Antifriction wheel, P. Little, Sr.... 746,117
Arsenic fumes, arresting, R. Baggaley.... 746,251
Assayer's pulverizing apparatus, J. Q. A. King.... 746,104
Automatic regulator, A. R. Dodge.... 746,047
Awning, window, C. J. Conradt.... 746,294
Bandage suspensory, E. R. Drake.... 746,747
Barrel holding and dumping apparatus, C. E. Ringrose.... 746,164
Basin or bath fitting, J. J. Wade.... 746,419
Bath cabinet heater, sweat, T. O. Carman. 746,018
Bath tub, I. W. Schmidt.... 746,389, 746,390
Battery. See Electric battery.
Battery circuit breaker, storage, H. Garrett.... 746,490
Beam trammel and calipers, R. A. Wilson.. 746,221
Bearing, roller, G. W. Sweeney.... 746,198
Bed and couch, combined, D. Schalk.... 746,584
Bed rail coupling, A. E. Jacobson.... 746,335
Bed slat fastener, A. N. Webb.... 746,211
Bed, spring, Crawford & Dixon.... 746,034
Beer pipe cleaner, E. M. Burroughs.... 746,012
Beet digger, Gary & Ostrom.... 746,067
Bending machine, W. H. Johnson.... 746,090
Bending machine, J. H. Baker.... 746,263
Bicycle lock, W. T. McNary.... 746,365
Bicycles, pneumatic seat post for, E. Brougham.... 746,279
Binder attachment, W. Umbeck.... 746,412
Binder, temporary, J. J. Duffy.... 746,052
Binder, temporary, J. A. Mudd.... 746,354
Blasting caps, device for protecting, D. B. Gillies.... 746,262
Boat releasing device, ship's, W. H. Rothwell.... 746,169
Boat, submarine, D. F. Toomey.... 746,606
Boiler and furnace, combined, W. W. Bonson.... 745,998
Boiler brace, J. F. Hottman, Jr.... 746,511
Boiler controller, Flinn & Aborn.... 746,485
Boiler furnace, E. F. Comber.... 746,031
Book, account, J. H. Rand.... 746,156
Bookcase, sectional, W. A. Shimer.... 746,589
Bottle, non-refillable, Kindig & Spicer, 746,102, 746,103
Bottle, non-refillable, H. Engel.... 746,313
Bottle, non-refillable, T. S. Philpott.... 746,374
Bottle valve mechanism, D. H. Monks.... 746,551
Bowling ball, J. T. Rice.... 746,576
Box fastener, Anger & Brenckle.... 746,986
Boxes, machine for making folding partition packing for shipping, C. A. Haas, et al.... 746,324
Bracket or clamp, A. Sonsthagen.... 746,188
Braid, M. Mittendorff.... 746,548
Braiding machine, L. W. Whitehead.... 746,215
Brake shoe and making same, W. D. Sargent.... 746,172
Brewing, H. E. Frees.... 746,320
Brick truck, I. C. Jones.... 746,520
Bridge construction, combined clamp and hanger rod for, G. F. Ernst.... 746,317
Broom attachment, C. D. Winne.... 746,428
Brush, A. R. Wiens.... 746,217
Brush holder, H. K. Brooks.... 746,450
Brush, paper hanging, Kerns & Ackley.... 746,099
Bug gatherer, F. Keener.... 746,098
Buggy top support, W. H. Tully.... 746,607
Bung, racking, C. L. Schalitz.... 746,386
Buttons, machine for filling character depressions in, Thyberg & Chapman.... 746,407
Cabinet, disappearing door, A. Pederson.... 746,569
Calculating machine, A. E. Bergey.... 746,995
Calendar and pen rack, combined, Von der Luhe & Bartholomew.... 746,540
Calendar, clock, J. L. Woods.... 746,225
Camera lens carrier, photographic, F. B. Case.... 746,459
Camera, photographic, H. W. Hales.... 746,327
Can. See Milk can.
Can capping machine, friction top, F. Neal. 746,564
Can filling apparatus, H. J. Hain.... 746,326
Can opener, adustable, F. L. Stork.... 746,195
Canning, machine for preparing fruit for, W. J. Latchford.... 746,530, 746,531
Car and door therefor, hopper gondola, R. V. Sage.... 746,385
Car bottom, E. W. Summers.... 746,602
Car brake, V. Waid.... 746,613
Car coupling, T. Chew.... 746,025
Car coupling, P. Hien.... 746,079
Car coupling, L. C. Carter.... 746,458
Car coupling, M. McConway, Jr.... 746,561
Car coupling auxiliary connection, W. N. Shephard.... 746,588
Car door, E. J. Lasher.... 746,109
Car door, H. Carlton.... 746,456
Car door, grain, A. G. Steinbrenner.... 746,400
Car, dumping, S. J. Johnson.... 746,519
Car, dumping, E. I. Morey.... 746,555
Car floor frame, H. Carlton.... 746,457
Car frame, mine, J. E. Jones.... 746,092
Car loading apparatus, R. Baggaley, 746,250, 746,252
Car, observation, J. Pejchar.... 746,371
Car, transfer stock, F. C. Roberts.... 746,381
Car underframing, railway, King & Frank. 746,340
Car vestibule diaphragm, S. D. Fuller.... 746,062
Car wheel, H. V. Loss.... 746,538
Cars, electrical annunciator for trolley, I. J. Bradshaw.... 746,001
Carbureter, C. E. Sayre.... 746,173
Carbureter, explosive motor, F. & G. Longuemare.... 746,119
Carbureter, gas engine, P. H. Brennan.... 746,449
Carding machine feed roll attachment, M. H. Gallagher.... 746,322
Carpet fabric, woven, T. Daffin.... 746,298
Cartridge decapping tool, H. M. Olney.... 746,368
Cash register, T. E. Davis.... 746,300
Caster, J. W. Lawrence.... 746,636
Casting machine, R. Baggaley.....746,237, 746,244
Casting machine, metal, R. Baggaley.... 746,245
Castings, producing carbon steel, J. C. Davis.... 746,039
Cattle delivering means, H. Bargeboer.... 745,992
Chain links, making, D. Carroll.... 746,287
Chair and couch, convertible, F. S. Bown.. 746,446
Cheese cutter, A. H. Hill.... 746,081
Chuck, plate, J. W. Carleton.... 746,284
Churn, G. Geer.... 746,629
Chute, spiral barrel, G. W. Allen.... 745,985
Circuit closing device, Thompson & Midgley.... 746,604
Clasp, H. R. Baker.... 745,990
Claw bar, F. D. Holbrook.... 746,083
Clock, geographical, G. Jeager.... 746,517
Closet seat cover, W. D. Lauer.... 746,111
Clothes line holder, W. P. Sampson.... 746,171
Coal furnace, soft, C. S. Hood.... 746,084
Coat, W. E. Smith.... 746,185
Cock, gas regulating, A. M. Gummer.... 746,500
Coffee pot, C. A. Robertson.... 746,165
Coin receptacle, H. J. Valentine.... 746,205
Coke drawer, D. Ferguson.... 746,055
Collar fastener, A. Reed.... 746,575
Collar, fold, W. Hess, Jr.... 746,078
Collar stretching and measuring apparatus, J. C. & R. A. Doring.... 746,048
Composition material, G. H. Moore.... 746,553
Computing and recording machine, F. S. Baldwin.... 745,991
Conduit joint mold box, E. L. Du Bois.... 746,051
Conduit section dowel pin, Field & Doolittle.... 746,628
Container joint, W. L. Austin.... 746,440
Converter, R. Baggaley.... 746,238
Conveyor, W. T. James.... 746,088
Cooling board, C. E. Windom.... 746,223
Cooling board, A. H. Emigh.... 746,311
Copper matte, converting, R. Baggaley.... 746,249
Copper, refining, R. Baggaley.... 746,246
Cord shortening device, J. H. Seaman.... 746,178
Corn husker feeder, C. W. Brierton.... 746,005
Corn husking device, W. L. Switzer.... 746,647
Corn husking machine, J., H. & H. Koelling.... 746,526
Coupling for air or other ducts, S. L. McAdams.... 746,360
Cradle motor attachment, M. W. Robinson. 746,166
Crane arm, E. O. & C. W. Rood.... 746,168
Crate, knockdown, Symes & Boyd.... 746,199
Crate, shipping, G. E. Hallaron.... 746,075
Cream separator, S. R. Barhite.... 746,264
Crossing, noiseless, P. J. Lassen.... 746,529
Cultivator, lister, O. E. Johnston.... 746,633
Culvert, A. Lauridtzen.... 746,112
Curb and conduit, combined, R. Raby.... 746,153
Curling iron heater, J. M. Lawlor.... 746,532
Current controlling device, automatic, P. R. Owens.... 746,140
Curtain cord winder, Bennett & Hunting.. 746,270
Curtain fixture, H. E. Keeler.... 746,097
Cut out, automatic, Borein & Desimone.. 746,273
Cutter. See Cheese cutter.
Dampener, spring, E. Denegre.... 746,043
Dash brace, vehicle, N. B. Stone.... 746,192
Dial plate, J. F. Stevens.... 746,600
Die and reamer, combined, A. O'Brien.... 746,137
Dining room service, continuous, H. I. Washburn.... 746,615
Dish drainer, M. G. Reeves.... 746,159
Disinfecting apparatus, L. Vandam.... 746,413
Display rack or stand, S. Erb.... 746,315
Door alarm, A. R. Strahan.... 746,196
Door hanger, W. B. Smith, reissue.... 12,181
Double boiler, A. J. Wentzel.... 746,213
Draft equalizer, H. R. Tomson.... 746,649
Dredge, R. R. Osgood.... 746,566
Drill pressure device, E. H. Ackerman.... 746,432
Drilling apparatus, Upton & Gilman.... 746,204
Drilling machine, W. A. Kagelmacher, Jr. 746,521
Driver's seat, adjustable, T. M. Ramsay.. 746,154
Educational appliance, H. O. Dunn.... 746,305
Egg cutter guide and regulating device, G. J. Haslam.... 746,505
Electric battery, S. Yai.... 746,227
Electric battery, M. R. Hutchison.... 746,514
Electric conductor, C. M. Clark.... 746,463
Electric fixture tripod box, J. E. Ercambrack.... 746,316
Electric lighting system, J. F. McElroy.... 746,361
Electric motors, controlling, M. Waddell, reissue.... 12,180
Electric motors, means for controlling, M. Waddell, reissue.... 12,179
Electric switch, A. Rivenburg.... 746,577
Electrical connection, F. J. Russell.... 746,580
Electrical distribution system, J. H. Hallberg.... 746,074
Electrical receptacle, P. H. Fielding.... 746,483
Electrical regulation system, M. Moskowitz.... 746,558
Electrical wire support, B. Cullen.... 746,469
Elevator bucket, S. E. Flock.... 746,486
Embroidery silk frame, M. V. Westbrook.. 746,214
Emery wheel dressers, hand device for holding, W. H. Gilbert.... 746,068
Engine electric igniter, gas, G. J. Rathbun.... 746,377
Engine exhaust box or silencer, explosion, A. Krebs.... 746,527
Engines, circulating apparatus for internal combustion, G. J. Murdock.... 746,358
Exhibitor, curtain, Haviland & Sicklesteel.... 746,506
Explosion engine, W. C. Weatherholt.... 746,212
Eyeglass fitting, J. C. Schmidt.... 746,175
Eyeglass frame, A. S. Van Denburgh.... 746,608
Eyeglasses, L. Kleb.... 746,341
Eyeglasses, G. H. Mayer.... 746,543
Fan, H. M. Kissling.... 746,524
Fatty substance and making same, O. Liebreich.... 746,636
Feed water heater, W. M. Wright.... 746,226
Feed water heater and purifier, T. V. Elliott.... 746,479
Feeding and band cutting mechanism, F. S. Rich.... 746,379
Fence, C. T. Hammack.... 746,503
Fence weaving machine, E. G. Overholt.... 746,139
Fence, wire, J. S. Barnes.... 746,441
Fender. See Vehicle fender.
Fiber cleaning machine, vegetable, T. Finigan.... 746,056
Fifth wheel antirattler, F. E. Wilcox.... 746,218
Filter, A. N. Clark.... 746,292
Filter, revoluble, G. Moore.... 746,552
Fireplace, D. C. Simons.... 746,182
Fireproof construction, H. L. Kubbernuss.. 746,345
Fish spear, A. J. Campbell.... 746,455
Fishing reel with adjustable head, A. F. & W. Meisselbach, Jr.... 746,544
Floor and strengthening member therefor, P. M. Bruner.... 746,009
Fluid pressure, developing and utilizing, J. C. Fraley.... 746,318
Fluid pressure developing and utilizing apparatus, J. C. Fraley.... 746,488
Fluids, regulating the supply of, F. Windhausen, Jr.... 746,222
Flushing apparatus, R. F. Gillin.... 746,324
Folding chair, H. G. M. Howard.... 746,085
Form, garment, A. K. Maxwell.... 746,350
Fruit sizing machine, A. C. Burk.... 746,011
Fuel blocks or briquets, manufacturing, O. Neugebauer.... 746,366
Fuel, composition of matter for artificial, A. Lohmann.... 746,118
Fuel into combustion chambers, apparatus for injecting pulverized, C. H. Gifford.... 746,493
Furnace, T. V. Elliott.... 746,310
Furnace feeder, W. T. Barker.... 746,265
Fuse or cut out, electric, L. W. Downes.. 746,050
Game apparatus, J. A. McKenzie.... 746,364
Game, card, H. E. Gavitt.... 746,492
Garment fastener, M. F. Eisner.... 746,478
Gas burner and heater, regenerating, J. W. McKnight.... 746,129
Gas burner mantles, Lippitt & Whitcomb.. 746,536
Gas burner regulator, W. G. Midgley.... 746,546
Gas engine, L. H. Nash.... 746,133
Gas generator, acetylene, O. Parker.... 746,568
Gas generator, acetylene, L. P. Powell.... 746,571
Gas, manufacturing, C. F. Brush.... 746,452
Gas or liquid supply pipes, cut off apparatus for, F. W. A. Wiesebrock.... 746,425
Gas producer charger, G. Sieurin.... 746,591
Gases, apparatus for arresting impurities from furnace, R. Baggaley.... 746,254
Gases, apparatus for precipitating injurious fumes from smelter, R. Baggaley, 746,236, 746,256, 746,257
Gases, apparatus for removing impurities from furnace, R. Baggaley.... 746,261
Gases, apparatus for the treatment of furnace, R. Baggaley.... 746,255
Gases, recovering values from smelter, R. Baggaley.... 746,259
Gear wheel, F. Saxon.... 746,583
Gearing, L. S. Clarke.... 746,027
Gearing, power transmission, G. E. Whiteside.... 746,216
Generator or motor suspension, Waddell & Brooks.... 746,610
Glassware, apparatus for fire finishing, A. R. Grotz.... 746,498
Globe or mantle protector, J. L. Cavanaugh 746,460
Go-cart, F. E. Southard.... 746,189, 746,190
Grain binder, C. A. A. Rand.... 746,155
Grain binder shocker attachment, C. J. Dowling.... 746,473
Grain cleaning, scouring, and cooling device, F. W. Hess.... 746,508
Grinding mill, J. C. Bowsher.... 746,275
Guano distributer, J. S. Byrd.... 746,282
Handle fastener, R. S., H. P. & E. C. Hoyt.... 746,086
Hanger. See Door hanger.
Harness breast bow, C. Severns.... 746,180
Harrow riding attachment, A. W. Perry. 746,146
Harrow, rotary, T. S. Wagoner.... 746,208
Harvester reel, W. H. Lightcap.... 746,534
Harvester shocking attachment, corn, D. T. Phillips.... 746,148
Hat and coat rack, bedstead, W. J. Dick. 746,301
Hat brim curling machine, D. Clerico.... 746,293
Hat pin, S. Wilkins.... 746,621
Hay press, J. B. Hall.... 746,073
Hay press, W. F. Nanney.... 746,132
Hay sling lock, F. B. Strickler.... 746,197
Heating and evaporating apparatus, continuous motion, H. D. Perky.... 746,145
Heating element, electric, J. F. McElroy.. 746,128
Heddle bar or support clamping device, Stimpson & Short.... 746,401
Hides and skins, machine for treating, F. J. Perkins.... 746,144
Hinge, J. Soss.... 746,398
Hinge, S. J. Hogan.... 746,509
Hinge, convertible, A. F. Enquist.... 746,054
Hinge, gate, J. D. Parkinson.... 746,142
Hinge, spring, E. Bommer.... 746,272
Hip reducer and hose supporter, combined, M. E. G. Darrah.... 746,037
Hitching device, F. Obiols.... 746,135
Hook and eye, C. E. Penman.... 746,372
Horse controlling device, J. V. Higgins.... 746,080
Horse overshoe, G. Batty.... 746,268
Horseshoes, making composition, G. J. Peacock.... 746,143
Hose and making same, armored, E. T. Greenfield.... 746,630
Hose coupling, armored, E. T. Greenfield.. 746,497
Hose supporter, A. H. Cohn.... 746,030
Hot air furnace, P. M. Bruner.... 746,008
Hot air heater, C. F. Brand.... 746,002
Hydrant, automatic, T. F. Murphy.... 746,125
Hydrocarbon burner, C. H. Knobbs.... 746,525
Hydrocarbon burner, liquid, D. J. Canchester.... 746,283
Hydropneumatic engine, L. Kessler.... 746,100
Ice conserver, H. S. Van Fleet.... 746,414
Incandescent mantle frame, E. Lippitt.... 746,639
Incandescent mantle package, J. I. Robin.. 746,645
Indicator, W. E. Adams.... 746,433
Indicator, C. F. Pidgin.... 746,570
Insect destroying machine, Kelley & Terrell.... 746,523
Insect trap, H. Andrews.... 746,435
Insulator, S. Bower.... 745,999
Insulator hanger or bracket, G. H. McFeaters.... 746,362
Internal combustion engine, E. Korting.... 746,342
Iron bars, cross jointed, K. Zucker.... 746,230
Ironing board, J. T. Jennings.... 746,518
Jewel setter, W. F. Boast.... 746,444
Joint and pipe support, J. N. Brennan.... 746,277
Journal lubricating device, R. Baggaley.. 746,243
Justifying mechanism, F. B. Converse, Jr.. 746,295
Label making and printing machine, F. Waite.... 746,209
Lacing attachment, shoe, A. A. De Loach.. 746,042
Lacing, shoe, J. McMahon.... 746,563
Lamp, T. S. Leese.... 746,637
Lamp chimney or bottle carrier, E. P. Henigan.... 746,077
Lamp, electric arc, Stogsdill & Schatz.... 746,601
Lamps, revolving canopy attachment for, M. J. Murdoch.... 746,559
Land roller, R. S. Buch.... 746,453
Latch spindle bearing, F. W. Schneider.. 746,176
Leather board or similar material, machine for manufacturing, A. H. Thompson.... 746,404
Leather creasing machine, Plummer & Witherspoon.... 746,150
Ledger or similar book, bank, J. H. Rand. 746,157
Leg, artificial, J. Johnston.... 746,336
Linotype machine, J. K. Van Valkenburg. 746,415
Loading apparatus, R. Baggaley.... 746,253
Lock, J. Schell.... 746,174
Lock box, E. L. Krag.... 746,106
Locomotive track sanding apparatus, alarm valve for, C. Longstreth.... 746,537
Log car toggle chain release, Ashcroft & Lubbers.... 746,438
Loom filling stop motion, W. A. Fowler.. 746,058
Loom, needle, B. Saner.... 746,581
Loom shuttle box motion, F. Hofmann.... 746,333
Loom shuttle lubricating device, D. McTaggart.... 746,131
Low water alarm, J. Arrance.... 745,987
Mail bag, C. H. Burton.... 746,013
Mail chute, F. E. Anderson.... 746,233
Mailing wrapper, E. H. Callahan.... 746,014
Marking machine, S. I. Prescott.... 746,376
Match, H. Gair.... 746,321
Matte, converting, R. Baggaley.... 746,241
Measuring instrument, angle, F. E. Hutchins 746,513
Meter. See Rotary meter.
Meter coupling, F. Sheridan.... 746,181
Milk can, L. Harvey.... 746,328
Milk compound and producing same, synthetic, W. A. Hall.... 746,502
Milk cooler, hydraulic, Z. C. Womble.... 746,623
Milk product resembling cheese and making same, J. H. Campbell.... 746,016
Mines, etc., safety mechanism for winding apparatus for, J. Berry.... 746,271
Molder's flask, Clapp & Sague.... 746,291
Monkey wrench, T. J. Robertson.... 746,382
Mower, lawn, W. Duckett.... 746,475
Mowing machine attachment, T. B. Fagan, reissue.... 12,182
Mud guard and luggage carrier, combined, A. T. Taylor.... 746,603
Muffler and chest protector, combination, Schoch & Schafer.... 746,586
Multicircuit controller, W. M. Scott.... 746,587
Musical instrument, self-playing, L. B. Dorman.... 746,472
Necktie fastener, H. E. Curtis.... 746,035
Necktie holder, L. F. L. Pynchon.... 746,573
Needle threader, W. A. Johnston.... 746,091
Nicotin trap and smoke cooling appliance for tobacco pipes, W. A. Ede-Clendinnen.... 746,308
Nozzle directing device, E. J. Lasher.... 746,110
Nut lock, J. A. Christ.... 746,026
Nut lock, W. Cronk.... 746,296
Nut lock, F. L. McGahan.... 746,363
Oar lock, E. Montreuil.... 746,642
Oil burner, McFarlane & Pushaw.... 746,562
Oil burner, W. R. Smith.... 746,596
Oils, machine for testing the lubricating power of, H. V. Blake.... 745,997
Open air furnace, A. Boyer.... 746,276
Optometer, A. J. Shellman.... 746,394
Ores, recovering values from silicious, R. Baggaley.... 746,260
Oven, bake, H. J. Wade.... 746,611
Oven reflector attachment, W. C. Trowbridge.... 746,203
Oxyhydrocarbon burner, C. W. Turner.... 746,409
Padlock, permutation, C. O. Tooker.... 746,202
Paper bag machine, L. P. Eisenbeis.... 746,309
Paper, etc., machine for perforating, J. B. Allen.... 746,625
Papering machine, wall, J. K. C. Scheer.... 746,585
Pencils, penholders, etc., rack for, J. Adair.... 746,231
Percolator, coffee, G. B. Fyfe.... 746,063
Perforating machine, A. M. Bovier.... 746,274
Photographic developing machine, B. J. Holcombe.... 746,632
Photographic negative cleaner, H. C. White 746,618
Photographic plate and film, isochromatic, L. Smith.... 746,594
Photographic printing frame, M. W. Armstrong.... 746,234
Piano pedal attachment, H. Kind.... 746,101
Piano, violin, L. Breitenmoser.... 746,004
Pick blades or other tools to their handles, means for attaching, G. Tippett.... 746,648
Pickling vat weight, C. G. Deible.... 746,041
Pipe bracket, steam, A. J. Beaton.... 746,269
Pipe cutting tool, F. A. Headson.... 746,076
Pipe die and reamer, combined, A. O'Brien 746,136
Pipe trimming tool, L. Emond.... 746,312
Pipes, means for coiling, C. L. Schalitz.... 746,387
Pistol, match shooting, J. J. Marshall.... 746,542
Plane, Carleton & Trask.... 746,285
Plane iron, J. W. Carleton.... 746,286
Planimeter, F. R. Williams.... 746,427
Planter, combined corn and potato, D. J. Sigfridson.... 746,592
Plate finishing machine, E. D. Tucker.... 746,408
Plow, J. D. Campbell.... 746,015
Plow attachment, W. H. Betts.... 745,996
Plow handle, S. Bredahl.... 746,003
Plumb, mason's, Moran & Grant.... 746,554
Pneumatic actuating device, G. S. Williams. 746,220
Pneumatic dispatch apparatus, B. C. Batcheller.... 746,267
Pneumatic tubes, sending device for, B. C. Batcheller.... 746,266
Pot. See Coffee pot.
Powder, apparatus for molding smokeless, F. I. Du Pont.... 746,375
Power, means for transmitting and equalizing variable, L. E. Gaylord.... 746,323
Preserving jar, J. M. Grau.... 746,496
Pressure regulator, S. L. McAdams.... 746,560
Printing, A. Hoz.... 746,087
Printing machines, pneumatic laying off apparatus for cylinder, W. M. Rockstroh.... 746,651
Printing press, C. H. Cochrane.... 746,464
Printing press shoo-fly, J. J. Mosher.... 746,124
Printing wall paper, hand press for, E. A. Popcke.... 746,152
Propelier, E. Bruncker.... 746,007
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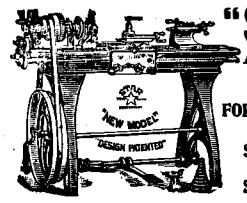

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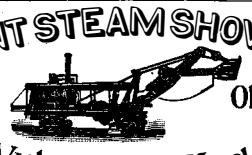

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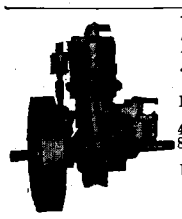

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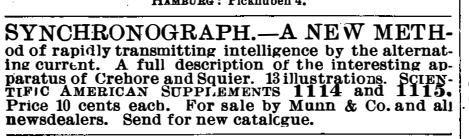

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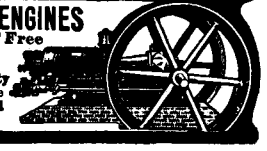

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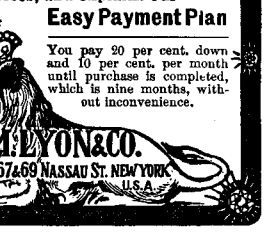

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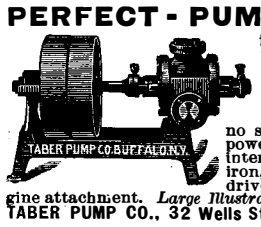

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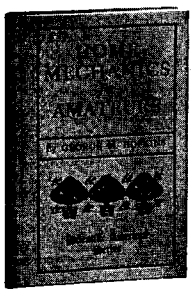

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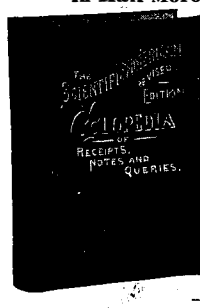

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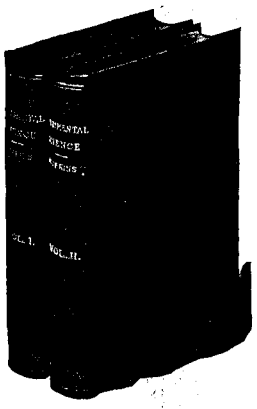

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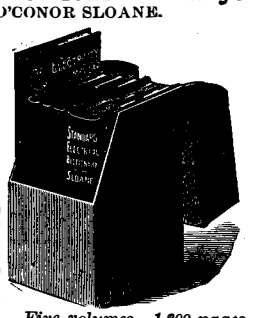

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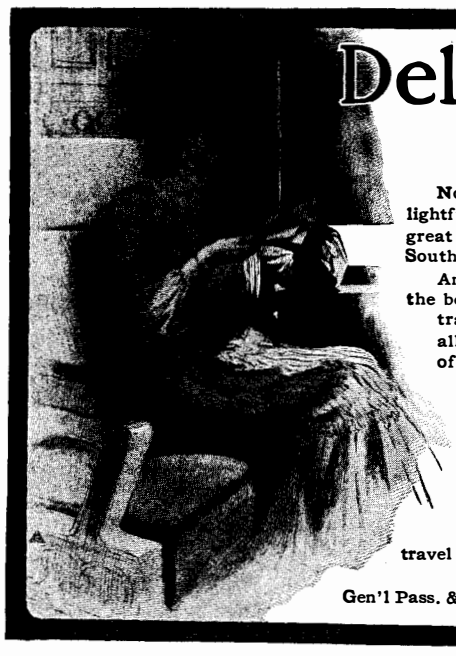

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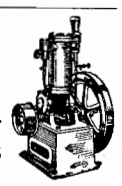

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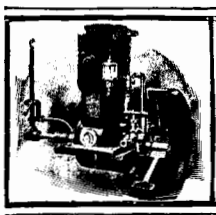

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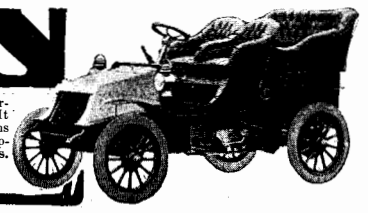

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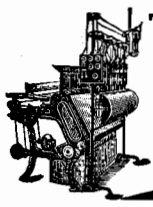

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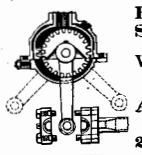

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